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ON CORMORANT FISHING IN JAPAN.

BY P. L. JOUY.

IN the clear mountain streams of Central Japan there is found a peculiar fish of the family *Salmonidæ*, the *Plecoglossus altivelis* T. & S. This fish, the "Ai" of the Japanese, is something between a trout and a smelt in appearance, grows to a length of twelve to fourteen inches, and is a bright silvery in color, with a golden spot on each shoulder. It is very delicate in flavor, and is much prized for the table. In a country celebrated for the variety and excellence of its fish, this species holds the highest place and commands the best price in the market. Many ingenious methods are employed for its capture, among the most interesting of which is the use of cormorants.

We are all familiar with the stories of cormorant fishing in China where the fisherman has his birds trained to obey a call-note or whistle, and where they sit around the edge of the boat, and go and return to and from the water like a well-trained spaniel; but cormorant fishing in a rapid mountain stream in Japan, is quite a different thing from fishing in a sluggish, muddy river in China, and I believe that the Japanese methods are quite unknown, being carried on at *night*, and in remote and out of the way places.

Before quoting from my note-book I will preface by stating that I made a journey, of about twenty-five miles, from Tokio to a small river, the Banugawa, on purpose to witness this interesting and, to me, novel sight.

September 8th, 1886. We left the tea-house about eight o'clock to keep our appointment with the cormorant fisher. It was

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a bright moonlight night, said to be a bad night for fishing, a cloudy or dull evening being preferred, as the fish were then not so active. The river consisted of two branches, running very swiftly, and each from twenty to fifty yards wide, but in flood-time it extended over a space of 200 yards or more, running between high bluffs. The man with his bird was waiting for us on the stony bed of the river, with his torch of pine-fat burning brightly. The bird (*Phalacrocorax* sp.) was very tame, and sat perched on a rock close by. A cord was tied pretty tightly around the lower part of the throat and between the shoulders, from which was attached a piece of bamboo (having a swivel at each end), long enough to extend beyond the bird's wings and prevent fouling of the cord while the bird was in the water. The man carried a basket at his side to put the fish in, and a sort of apron in front to hold pine chips for the light. The lantern was a wire cage or basket placed on the end of a long bamboo pole. This, with the cord attached to the bird, which gives him a range of about twenty feet, is held in the left hand, the right being employed in guiding the bird, replenishing the fire and taking the fish.

Everything being ready, the fisherman takes the torch in his left hand, and clasping the cord, to which the bird is attached, wades out into the stream, the bird following him and, after performing a hasty toilet, dipping his head and neck in the water and preening himself, begins the business of the night. The fisherman holds the fire directly in front and above the bird's head, so that it can see the fish in the clear water. The bird seems to be perfectly fearless, and as he comes up sparks of fire are constantly falling on his head and back.

The fishing is done up-stream, the man finding it all he could do to keep pace with the bird as the water surges up nearly to his thighs; in fact it was hard work for us on shore to scramble along among the rocks in the uncertain light and watch the bird at the same time.

The bird dives, swims under water for eight or ten yards, comes up and is down again, working very rapidly and constantly taking fish. When the fishes are small the bird is allowed to retain two or three in his throat at a time, but a fair-sized fish is immediately taken from him and put into the basket.

During a space of half an hour fifteen fishes were taken, which was pronounced a good catch considering the brightness of the

night. The largest of these fishes, which were all of the same species, were nine to ten inches in length, and having been taken immediately from the beak of the bird were scarcely bruised. The largest and best of these we had the next morning for breakfast, the others we gave to our friend, the cormorant, who was kindly assisted by his master to get them past the cord which constricted his throat so that he could not otherwise have swallowed.

The birds are trained especially for the work, and do not fish in the day-time. Our bird was two years old, and was considered a very bright and active fisher, having on good nights, fishing all night, caught as many as 400 fishes,—300 was considered a fair night's work. Only calm nights are available, and the darker the better.

THE MECHANICAL CAUSES OF THE ORIGIN OF THE DENTITION OF THE RODENTIA.

BY E. D. COPE.

THE phylogeny of the Rodentia as an order is now tolerably clear. I at first suggested,[1] and later asserted, that this order was derived by descent from the Tillodont suborder of the Bunotheria. The Tillodont suborder had a common origin with the Tæniodonta, from some type of Bunotheria with unspecialized molars and premolars, in which some of the incisor teeth had begun to display enlarged size. A form allied to this ancestor is the genus Esthonyx, which differs from it in but few respects. Professor Ryder, in discussing the origin of the Rodentia,[2] writes as follows:

"The significance of accessory rudimentary incisors present in some forms of true rodents, as pointing to the manner in which the evolution of the rodent type of dentition took place, may be overrated; yet when it is borne in mind that in other groups the appearance of diastemata between the different kinds of teeth took place gradually and in a way which unmistakably shows the gradual steps of the

[1] American Naturalist, April, 1883; Report U. S. Geol. Surv. Tertiary Vertebrata, 1885, 814; American Naturalist, April, 1884.

[2] Proceed. Academy Philada., 1877, p. 317.

process, we may be excused for thinking the same to have been the case here, although without positive tangible evidence in the shape of intermediate fossil forms that exhibit such a passage from the ordinary type." In 1852 I had the pleasure of discovering a genus [1] (Psittacotherium Cope) which supplies the desideratum wanting when Professor Ryder wrote. This is a genus, without diastema, and with two effective rodent-like incisors in each ramus of the lower jaw. Ectoganus Cope is probably similar in these respects, but only its separate teeth have been found. Psittacotherium is, then, a generalized type, and is not far from, if not directly in, the line of the ancestry of all Rodentia. It belongs to the Puerco fauna, which embraced so many of the progenitors of later Mammalia (Fig. 1).

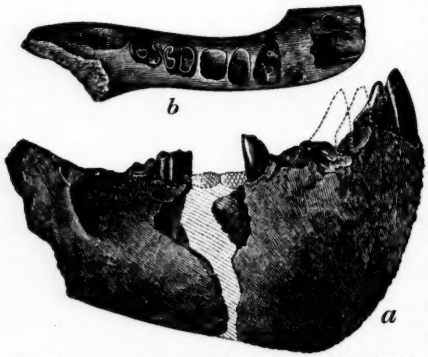

FIG. 1. *Psittacotherium multifragum* Cope, left mandibular ramus, one-half natural size. Original; from Puerco bed of New Mexico. Fig. *a*, external view; *b*, superior view.

I have called attention to the fact that the first inferior incisor is rudimental in Calamodon, and Marsh has shown the same thing in Tillotherium. In both genera the second incisor is the effective tooth. The third is present in Calamodon (Fig. 2). In Tillotherium the third incisor is apparently wanting. In Psittacotherium the first incisor tooth is present and effective, but the second is larger. It is not certain whether these are first and second, or second and third incisors. If we allow Esthonyx to decide the question, the large second tooth is truly the second incisor, for in that genus the first incisor is small, and the third is rudimental. With present information, then, the inferior incisor of the Rodentia is the second of the Mammalian series.[2]

[1] American Naturalist, Feb., Tertiary Vertebrata, 1885, p. 195.

[2] I have regarded (Naturalist, 1884, April and earlier) the Tæniodonta as the ancestors of the Edentata. The objection to this view is the supposed absence of inferior incisors in the latter. But the middle incisors

The peculiarities of the rodent dentition consist, as is well known, in the great development of the incisors; the loss of all but one, or rarely of two, of the premolars, which leaves a wide diastema; and the posterior position of the molar teeth, as relates to the rest of the skull. A peculiarity which belongs to the highest types of the order is the prismatic form of the molars, and the deep inflection of their always transverse enamel folds, both laterally and vertically. A peculiarity of the masticating apparatus, which is the basis of distinction from the Bunotherian order, is the lack of postglenoid process, and the consequent freedom of the lower jaw

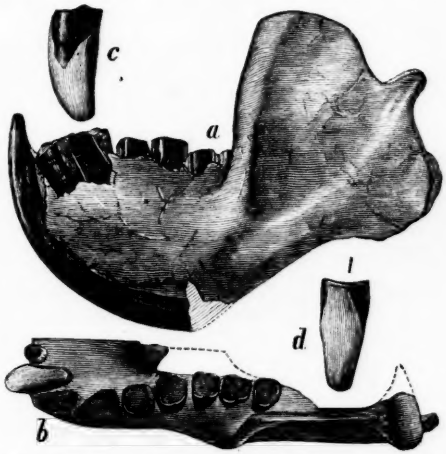

FIG. 2. *Calamodon simplex* Cope, lower jaw, left ramus, one-third natural size. Original, from Wasatch Eocene, of Wyoming. Fig. *a*, external view; *b*, superior, *c-d*, inferior molar; *c*, exterior; *d*, posterior views.

to slide backward and forward in mastication. Appropriately to this motion the condyle of the mandible is either subglobular, or is extended anteroposteriorly, and the glenoid cavity is a longitudinal instead of a transverse groove.

The mechanical action of the development of the rodent dentition has been as follows: The first factor in the order of time and importance was the increasing length of the incisor teeth.

are disappearing from the Tæniodonta, while the supposed canines of the lower jaw of Megalonyx and allies may be true incisors. This is rendered probable by the genus Diadomus of Ameghino, where the large canine-like teeth are found close together at the symphysis mandibuli, like the incisors of Tæniodonta and Rodentia.

Those of the lower jaw closed behind those of the upper in the progenitors of the Rodentia (*e. g.*, Esthonyx), as in other Mammalia. Increase of length of these teeth in both jaws would tend to keep the mouth permanently open, were it not for the possibility of slipping the lower jaw backwards as it closed on the upper. This backward pressure has undoubtedly existed, and has operated from the earliest beginning of the growth of the rodent incisors. The process has been precisely the opposite of that which has occurred in the Carnivora, where the pressure has been ever forwards, owing to the development of the canines.[1] The

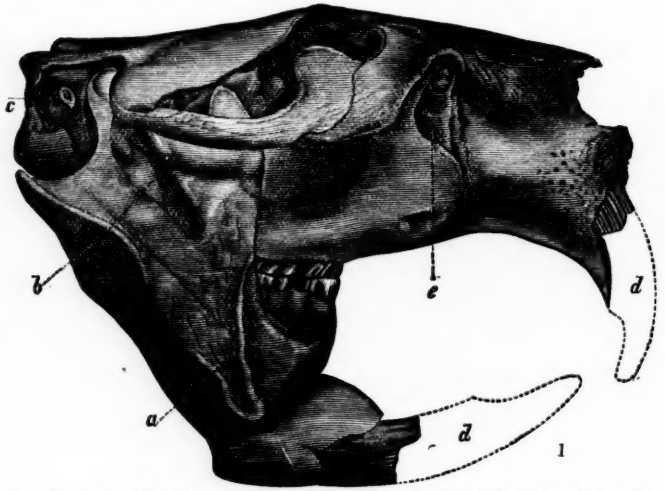

FIG. 3. *Castoroïdes ohioensis* Foster, skull, right side, two-fifths natural size. Fig. *a*, inferior insertion of masseter muscle; *b*, fossa in side of ascending ramus; *c*, external auditory meatus; *d*, incisors; *e*, foramen infraorbitale. From Hall & Wyman.

progressive lengthening of the incisors through use has been dwelt on by Professor Ryder (l. c.). The posterior pressure on the lower jaw, produced by its closing on the upper, has been increased directly as the increase of the anteroposterior length of the incisors, especially those of the lower jaw.

The first effect of this posterior pressure will have been to slide the condyle of the mandible posteriorly over the postglenoid process, if any were present, as is probable, in the bunotherian ancestor of the rodent. Continued repetition of the movement would probably push the process backwards, so as to render it ineffective as

[1] Proceed. Amer. Assoc. Science, 1887.

a line of resistance, and ultimately to flatten it out, and atrophy it. The lower jaw would thus come to occupy that peculiarly posterior position which it does in all rodents.

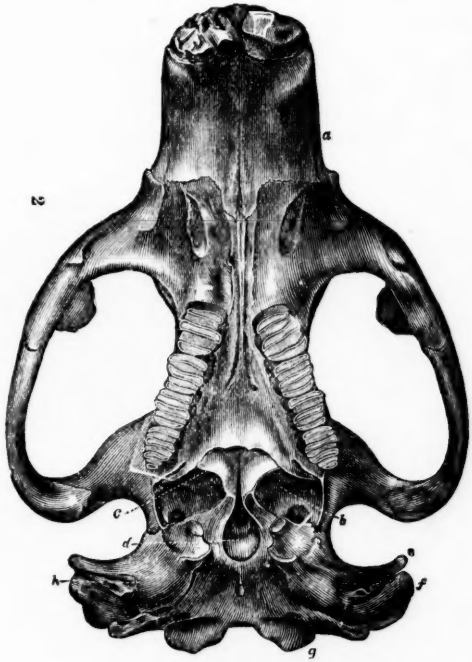

FIG. 4. *Castoroïdes ohioensis* Foster, two-fifths natural size, skull from below. Fig. *a*, incisive foramen; *b*, pterygoid fossa; *c*, internal pterygoid plates; *d*, fossa in basioccipital bone; *e*, external auditory meatus; *f*, mastoid process; *g*, occipital condyles; *h*, tympanic bulla; after Hall and Wyman.

The anteroposterior (propalinal)[2] type of mastication becoming necessary, an appropriate development of the muscles moving the lower jaw, with their insertions, follows *pari passu*. As a result we see that the insertion of the temporal muscle creeps forwards on the ramus, until in the highest rodents (Cavia) it extends along the ramus to opposite the first true molars. The office of this mus-

[2] See Naturalist, Nov., 1887, p. 991, for explanation of the different modes of mastication. The propolinal mastication is to be distinguished into the proal, from behind forwards (the Proboscidea, Ryder), and the palinal from before backwards (the Rodentia, Ryder).

cle is to draw the ramus backwards and upwards, a movement which is commenced so soon as the inferior incisor strikes the apex of the superior incisor on the posterior side. By this muscle the inferior molars are drawn posteriorly and in close opposition to the superior molars. Connected with this movement, probably as an effect, we find the coronoid process of the mandible to have become gradually reduced in size, to complete disappearance in some of the genera, *e.g.*, of Leporidæ. In these genera the groove-like insertion of the temporal muscle develops as the coronoid process disappears.

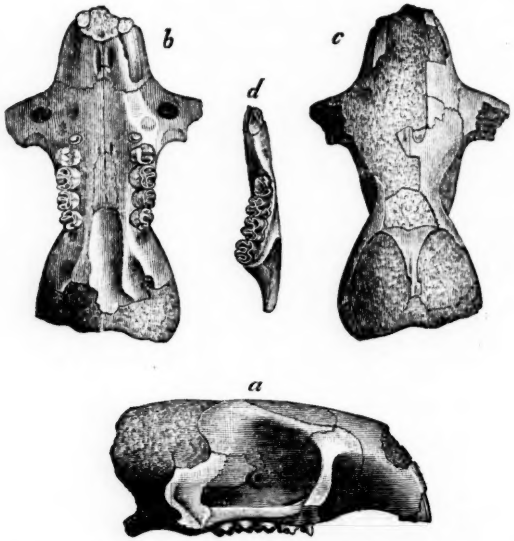

FIG. 5. *Ischyromys typus* Leidy, natural size, from the White river beds of Colorado; original, from the Report U. S. Geol. Surv. Terrs. *a*, *b*, *c*, cranium; *d*, mandible from above.

As third and fourth effects of the posterior position of the lower jaw, we have the development of the internal pterygoid and masseter muscles and their insertions and origins. The angle of the ramus being forced backwards, these muscles are gradually stretched backwards at their insertions, and their contraction becomes more antero-posterior in direction than before. The internal pterygoid becomese specially developed, and its point of origin, the pterygoid fossa, becomes much enlarged. The border of the angle of the mandible becomes more or less inflected. In their effect on the move-

ments of the ramus they oppose that of the temporal muscle, since they draw the ramus forwards. They are the effective muscles in the use of the incisor teeth, that is, in the opposition of the inferior incisors against the superior, from below and posteriorly. Hence the great development of the internal pterygoid, and, in a less degree, of the masseter. Both muscles tend also to close the jaws, but at a different point in the act of mastication from that at which the temporal acts. If we suppose the mouth to be open, the action of the masseter and internal pterygoid muscles draws the mandible forward and upwards until the incisors have performed their office, or the molars are in contact with each other or with the food. They then relax, and the temporal muscle continues the upward pressure, but draws the ramus backwards to the limit set by the adjacent parts, causing the act of mastication.

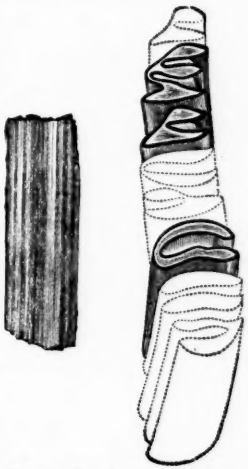

FIG. 6. Teeth of *Hydrochœrus œsopi* Leidy, natural size. From Charleston, S. C. After Leidy. *a*, fragment of superior incisor; *b*, the shaded portions represent parts of inferior molars found.

A fifth effect of the development of the incisors, and of the propalinal mastication, is seen in the positions of the molar teeth. The indefinitely repeated strain and pressure applied to the superior molars from forwards and below, has evidently caused a gradual extension of the maxillary bone backwards, so that the last molars occupy a position much posterior to that which they do in other orders of mammals. This is especially the case in such forms as Bathyergus, Arvicola and Castoroïdes (Fig. 4), where the last molars are below the temporal fossa, and posterior to the orbit.

A sixth effect of the causes mentioned has been referred to by Ryder.[1] This is the oblique direction of the axes of the molar teeth. These directions are opposite in the two jaws; upwards and forward for the lower, and downward and backwards for the upper. The mechanics of this change of direction from vertical in the primitive forms (Sciuridæ) to oblique in the genera with prismatic molars, is simple enough. The inferior crowns, when

[1] Proceed. Acad. Philada., p. 66, Figs. 8, b and f.

closely appressed to the superior, and drawn posteriorly in the direction of the long axis of the jaw, press and strain the teeth in the two directions mentioned. The development of the long prismatic crowns which has proceeded under these circumstances, has been undoubtedly affected by the pressure and strain, and the direction we find has been the result.

The seventh effect is in the detailed structure of the teeth themselves. Beginning with short crowns with simple transverse crests, (Psittacotherium and Sciuridæ, Figs. 1 and 5), we reach, through intermediate forms, crowns with vertical laminæ of enamel, which sometimes divide the crown entirely across (Chinchillidæ, Caviidæ, Castoroididæ), or appear only on the ends of the crown, through the continued coalescence of the prisms of which each molar crown is composed (Arvicola). In many instances the crowns increase in transverse at the expense of their longitudinal diameter (Castor, Lepus). The vertically laminated structure is evidently due to the crowding together of transverse crests by the same pressure which has given the crowns their oblique direction. In many genera the lengthening of the crown has included the lengthening of the longitudinal connection between the transverse crests, as in Arvicola, Castor and Hystricidæ generally. In others this connection has not been continued, so that the crown is composed of prisms which are separate to near the base, as in Amblyrhiza and Saccomyidæ. In others, connection between the prisms has been lost by cœnogeny, as in Chinchillidæ and Caviidæ generally. The latter families display also the greatest amount of crowding (Fig. 6).

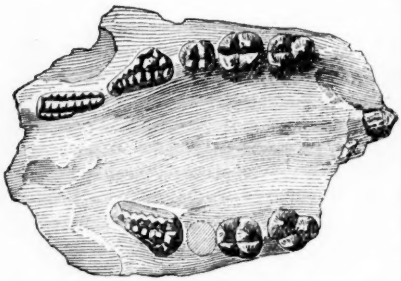

FIG. 7. *Chirox plicatus* Cope, palate and molar teeth from below, three-halves natural size. From Puereo bed of New Mexico. From American Naturalist, 1887, p. 566.

A peculiarity of the plication of rodent molars I am unable to explain as yet on mechanical principles. In genera which are isognathous, the inflections are of equal depth on opposite sides of both superior and inferior molars. In anisognathous genera

the inflections are more numerous and profound on opposite sides of the molars of the respective jaws. Anisognathism in rodents is generally, as shown by Ryder, of the type where the inferior molars include a wider expanse than the superior, though this

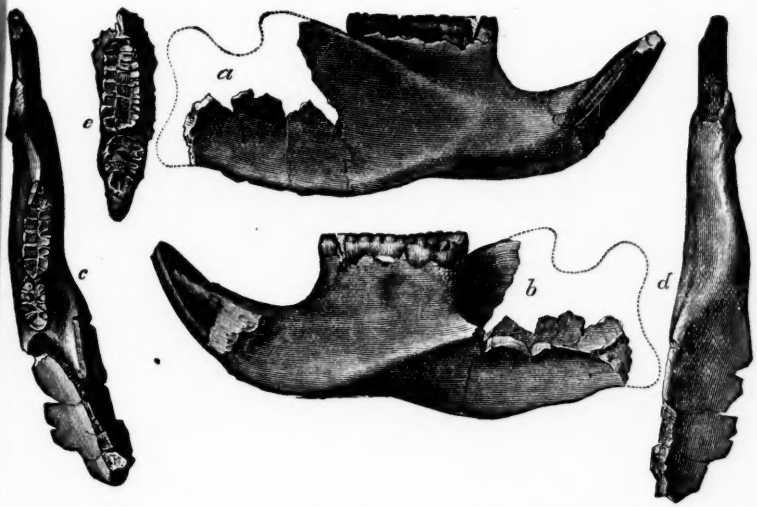

FIG. 8. *Polymastodon taïensis* Cope, jaws, two-thirds natural size, from Puerco bed of New Mexico. Figs. *a-d*, lower jaw; *e*, upper jaw. Original.

applies in some instances more to the direction of the roots rather than the position of the crowns. In Lepus the lower jaw is the narrower. The two types of anisognathism may be termed hypanisognathism (Lepus, Diplarthra) and epanisognathism (Caviidæ). The following genera display these characters:—

Hypanisognathous.	*Isognathous.*	*Epanisognathous.*
Lepus.	Arvicola.	Hystricidæ.
	Capromys.	Castor.
		Caviidæ.

In conclusion I will say that it is satisfactorily proven to my mind that nearly all of the peculiarities of the Rodent dental system, and manner of mastication, are the mechanical consequences of an increase in the length of the incisor teeth. And the increase in the length of these teeth has been due to their continued use, as believed by Ryder.

NOTE ON THE MARSUPIALIA MULTITUBERCULATA.—The structure of the dentition of this suborder is in many respects like that of the Rodentia in the known forms. The incisors in the Plagiaulacidæ, Chirogidæ and Polymastodontidæ have structure and functions generally similar to those of the Rodentia. The result in the form and function of the molar dentition has been similar to that observed in the Rodentia. The postglenoid process is probably absent in these animals; in any case the mandible, or condyle, is rounded and is not transverse. Professor H. F. Osborn has pointed out to me that mastication was performed by a fore and aft movement of the inferior molars on the superior, in Plagiaulacidæ. This was no doubt the case in the other families named. The resulting structure of the crowns is, however, different, and needs explanation. The molar teeth present conical tubercles in longitudinal series, two in the lower, and three in the upper jaw. The two series of the lower jaw alternate with the three in the upper jaw, moving in the grooves between the latter, while the three series of the upper molars reciprocally embrace the two of the lower molars. This is demonstrated by the mutual wear of the tubercles seen in Ptilodus and Chirox (Fig. 7). The trituration was probably the same in Tritylodon, but in Polymastodon the increased thickening of the tubercles prevented their interlocking action in mastication. In this genus the tubercles slid over each other, and truncated the apices until in old specimens they were entirely worn away (Fig. 8 *c e*). In Meniscoëssus and Stereognathus we have an interesting illustration of the effect of the action of cusps on each other when under prolonged mutual lateral thrust. Their external sides have been drawn out into long angles in the direction of thrust, converting their transverse sections from circles to crescents. As the thrust is in the longitudinal Multituberculata, the crescents are

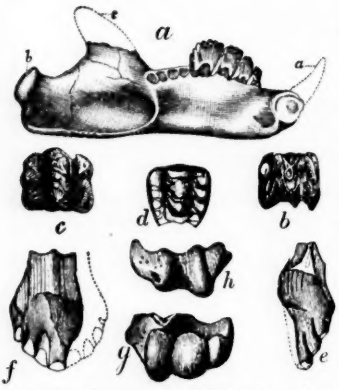

FIG. 9. Marsupialia Multituberculata. Fig. *a*, *Ctenacodon serratus* Marsh, ⅔ from Marsh; *d*, *Meniscoëssus conquistus* Cope three-halves natural size; *b*, superior molar *g e*, humeral condyles; *f h*, premolar. Fig. *d*, *Stereognathus oöliticus* Owen ⅔, from Owen; *c*, *Tritylodon longaevus* Owen ⅔, from Owen.

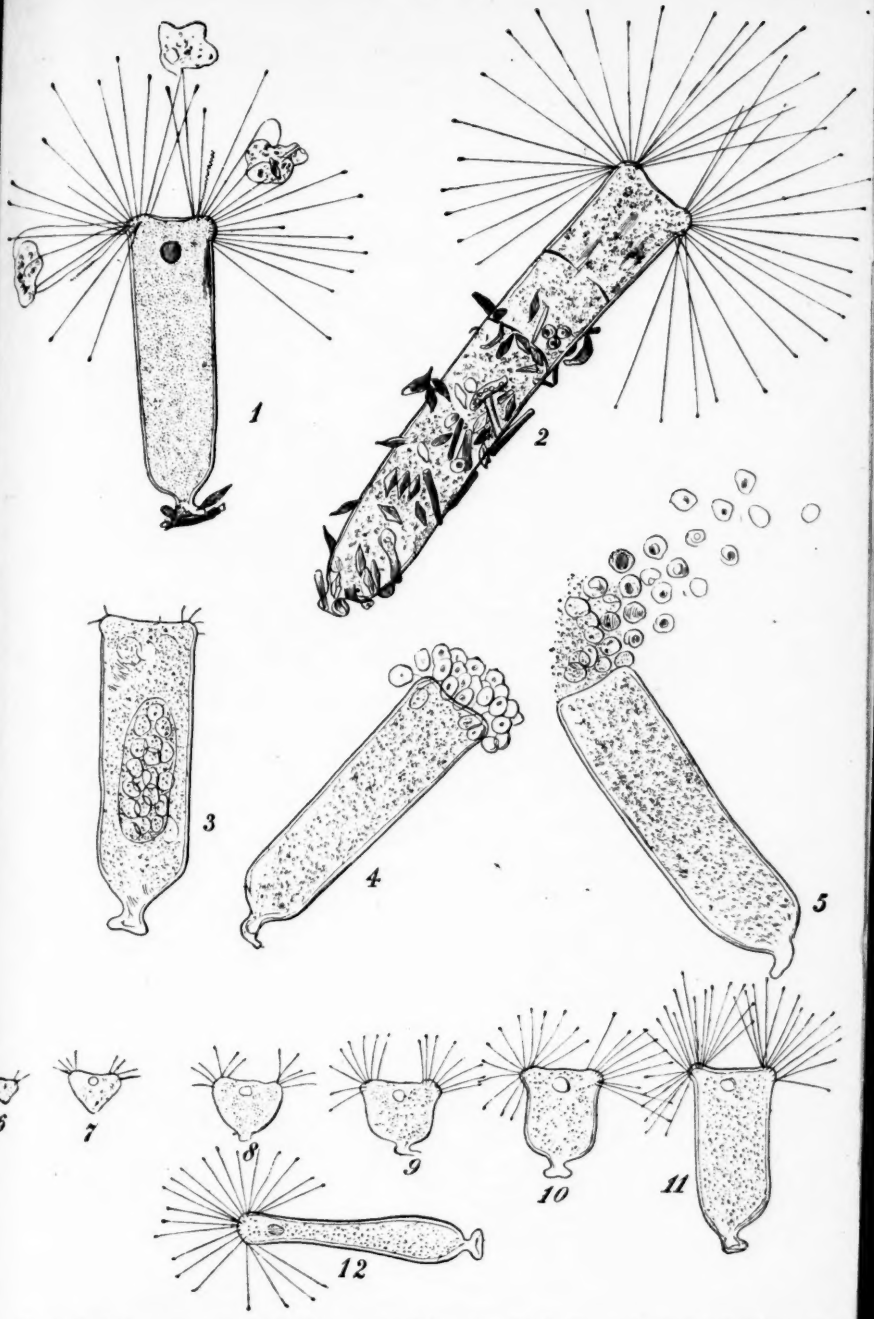

Fig. 1. Podophrya compressa, with three captured Amœba. Fig. 2. Unusually large individual. Figs. 3-11. Various phases in reproductive process. Fig. 12. Animal as it appears in side view.

transverse to the axis of the jaw. In the selenodont Diplarthra, where the thrust is transverse to the line of the jaw, the crescents are longitudinal. That similar effects should accompany similar movements in two groups of Mammalia so widely separated as these two, is strong evidence in favor of the belief that the two facts stand in the relation of cause and effect (Fig. 9, Figs. *b* and *d*).

DESCRIPTION OF A SUPPOSED NEW SPECIES OF ACINETAN, WITH OBSERVATIONS ON ITS MANNER OF FOOD INGESTION AND REPRODUCTION.

BY C. C. NUTTING.

PODOPHRYA COMPRESSA Nutting.

DESCRIPTION:—Body illoricate, quadrate, wider anteriorly; length from two to five times the greatest width; compressed, about three times as wide as thick; the anterolateral corners occupied by rounded prominences, each bearing a fascicle of many suctorial tentacles which, when fully extended, are more than half the length of the body, and spiral or spirally marked when retracted; posterior portion of body rapidly narrowing to meet the very short thick pedicle which is furnished with a sucking disk at its distal end; parenchyma densely and evenly granular; contractile vacuole single, anterior; endoplast oval.

Length of body, 1–277″ to 1–140″.

Habitat. Fresh water.

The above-described species has recently been numerous in a fresh-water aquarium in the Biological Laboratory of the State University of Iowa, where it was first noticed by Professor S. Calvin, who kindly delegated its investigation and description to the writer.

In general appearance it somewhat resembles certain species of the genus *Acineta*, but the absence of any indication of a lorica excludes it from that group, and it is hence, with some doubt, placed in the genus *Podophrya*, with which it agrees in possessing distinctly capitate, fasciculated, suctorial tentacles only. It is

more like *P. buckii* than any other species heretofore described, but differs from it in possessing a distinctly compressed instead of cylindrical body, and in having a distinct, though short and thick pedicle.

Whether this is a new species or not, the observations made on its food ingestion and reproduction are, perhaps, of sufficient interest to justify publication.

Although in two instances this animal was observed to capture ciliated Infusorians, its preference is decidedly for the Amœba, which are abundant in the aquarium referred to. No sooner does an Amœba come within reach of the long suctorial tentacles of the Acinetan than the dish-shaped suckers fasten firmly on their prey and draw it nearer to the body of the captor. On some occasions the capture and subsequent ingestion were observed to be effected by one tentacle only, while on others many were employed in the operation. In one instance three Amœba were held and ingested at once (Fig. 1).

The ectosarc is soon punctured, *how* we could not discover, and almost immediately the body of the Amœba begins to decrease in size, its rounded outlines disappear, and in a short time after the capture it is reduced to a shapeless mass of flat and wrinkled ectosarc, the endosarc having been completely sucked away with the exception of the remains of diatoms and other objects too large to be drawn through the tentacular canal. The investment of ectosarc is then discarded, and the tentacles withdrawn and made ready for other victims.

The above observations were made with a one-fifth objective. A one-twelfth immersion objective yielded still more interesting and instructive results. As good fortune would have it, the Acinetan under observation almost immediately captured two Amœba. One was caught at first by one tentacle only, which was then partially retracted, when several other tentacles curved around and grasped the prey in a close embrace, at the same time applying their several suckers, which seemed to be pressed out flat against the outside of the Amœba. In a few seconds the ectosarc was pierced, when suddenly a rapid stream of granular protoplasm was seen flowing down the interior of the tentacles and into the body of the captor. So strong was this current that the particles flowing through the tentacles were forced in a rapid stream some distance into the parenchyma of the Acinetan, while in the body

of the Amœba the suction was so strong that particles were seen to rapidly converge from all directions to the points where the suckers were applied.

After exhausting the contents of the Amœba, one of the tentacles was seen to *violently eject a stream of granular protoplasm.* This was twice repeated, but the last time the act followed a slight pressure on the cover glass. On no other occasion was this ejection observed, but the query at once arises—Are these suctorial tentacles at times excretory in function?

This seems hardly credible in view of Huxley's statement, "Solid food is not ingested through these tentacles" (Anatomy of Invertebrated Animals, Am. Ed., p. 94), but a subsequent observation removed this difficulty. On this latter occasion a Ciliated Infusorian rapidly crossing the field came in contact with one or more of the extended tentacles of the Acinetan, which immediately grasped the victim, and held it in spite of its violent struggles. Four incisions were made in the ectosarc of the prey, and soon four rapid streams of protoplasm were passing into the body of the captor, rapidly exhausting the endosarc of the Infusorian, although its cilia continued in motion long after the animal was reduced to a mere fraction of its former proportions. During this process *solid colored granules* were seen to pass from the body of the victim through the tentacles and into the body of the Acinetan. This observation was verified upon at least one other occasion.

The ingestion of solid food would seem to render an excretory organ necessary to the Acinetan, and if this is so it seems at least possible that the suctorial tentacles may serve the purpose.

In regard to the manner of ingestion of food by the Suctoria, several of the leading authorities, including Maupas and Kent, hold that there is a double current of protoplasm in the tentacle, one of granular protoplasm passing into the body of the Acinetan, and another of colorless sarcode passing in an opposite direction. The writer has failed to find any evidence of the latter current, although his purely negative testimony is of little weight. Still the question might be pertinently asked: Why does not this colorless stream, pouring into the body of the victim, produce a current among the protoplasmic granules of the latter, which is directed *away* from the distal extremity of the suctorial tentacle? A number of observations under favorable circumstances failed to disclose the existence of any such currents, although strong currents toward the point of incision were always distinctly seen.

The structure of the suctorial tentacles, as described by Kent, is that of a hollow tube traversed internally or externally by a spiral filament or granular crest, which appears as transverse striæ when the organ is fully retracted. The writer has in vain attempted to assure himself of the correctness of this view as regards the species under consideration. It may be that a higher magnification would reveal the structure above alluded to, but a one-twelfth immersion objective[1] used under favorable conditions of light, etc., and repeated observations have shown what seems to be merely a *coiling and uncoiling of the entire tentacle*, without any indication of the large central core figured in Plate xlviii., fig. 22, of Kent's Manual of the Infusoria. The extension and retracting of the tentacle appears to be effected by the uncoiling and recoiling of the whole organ.

In working out the method of reproduction of this species, the writer was at first entirely misled by discovering a specimen with embryos clustered around its anterior end as represented in fig. 4. The resemblance of this to the exogenous gemmation said to be common in the genus *Hemiophrya*, at least, and figured in Plate xlvii., fig. 8, Kent's Manual of Infusoria, was so striking that there seemed hardly a doubt as to the interpretation; and had no more observations been practicable, the species would have been described as reproducing by exogenous gemmation. The question naturally arises: May not others have been misled in a similar way, and may not exogenous gemmation be much more rare among the Suctoria than has been commonly supposed?

The life history of this Acinetan discloses the following stages, several of which merge almost insensibly into each other:

1st. The parent form suffers the loss of its suctorial tentacles, which seem to shrivel up and gradually disappear. Fig. 3.

2d. Internal embryos of a round or oval shape make their appearance in considerable numbers in the endosarc of the animal. Fig. 3. This process is accompanied and preceded by an unwonted activity in the granular protoplasm of the parent.

3d. These embryos escape through the anterior portion of the

[1] Since writing the above, satisfactory observations have been made with a magnifying power of 1600 diameters, which have confirmed the view here advanced. Indeed there seems no room for doubt so far as the present species is concerned, whatever may be the facts in regard to others.

ectosarc of the parent, but remain for some time just outside of the latter, and apparently attached to it either by a sort of plasma or by short stalks. Fig. 4.

4th. The embryos develop cilia and swim away as free, ciliated embryos. Fig. 5.

5th. The ciliated embryos become fixed to some object and acquire a triangular shape and a few (three or four) suctorial tentacles at each antero-lateral angle. At about this time the single anterior contractile vacuole appears. Fig. 6.

6th. The animal now grows longer, and gradually acquires more suctorial tentacles until the adult form is reached. The development is illustrated in figs. 7, 8, 9, 10, 11, none of which are hypothetical, each having been observed by the writer.

Fig. 2 represents an individual of nearly twice the ordinary length, showing two transverse constrictions or markings of the ectosarc. In this, as in most other specimens examined, the animal is largely obscured by various objects, which seem to adhere to its surface as if it were covered by a viscid substance.

AN INQUIRY INTO THE STATE OF EARTH'S INTERIOR.

BY IRA SAYLES.[1]

THERE seems to be a strangely broad difference between the conclusions of the geologists and the physicists on the condition of Earth's interior. This broad difference, therefore, invites every thinker to think for himself, and to conclude as best he may be able. As a thinker I enter the lists.

It is manifest, from a bare inspection of the question at issue, that it demands both the inductive and deductive processes of ratiocination. Inductively, the fact of heat must be established, its extent established, and its persistence established: deductively must its maximum be reached, it effects be reached, and the main results of these effects be reached.

[1] U. S. Geological Survey.

The geologist observes the lines of volcanoes girdling the earth as it is, and concludes that *there must be a very extensive ocean of molten matter beneath Earth's crust*, to say the least.

He turns his attention to the great continents with their mountain ranges, high plateaus and low broad valleys, and finds a somewhat astonishing degree of instability everywhere. Upheavals and submergences are everywhere in progress. From these signs he argues, and that rightly, that *there must be a translation of matter from point to point beneath the surface.*

This, he further argues, is consistent with fluidity only. A very legitimate conclusion surely.

He takes another line of observations. He descends into the crust of the earth, and everywhere finds *the temperature augmenting as he descends.* Though this augmentation is constant, the rate of increment is not in all places the same. Still, however, this universal fact of increase of heat points straight to one conclusion, and corroborates the conclusion drawn from volcanoes, elevations or upheavals and submergences, viz., *the temperature of liquefaction must be reached.* All known rocks must become fluid.

He turns to the record Earth has kept of her past history. There he finds that, in all geologic history, upheavals and submergences have been common everywhere. He finds volcanoes have always existed. Moreover, he finds that great gaping rents have lacerated Earth's adamantine bosom, and that through these huge rents vast streams of molten matter from the interior have gushed out over land and into ocean, spreading devastation wherever it flowed.

He now discovers that this molten condition of the interior has remained a persistent fact from the very earliest geological eras—undetermined millions of Earth's years—*millions*, not thousands. Millenniums are but days in this great record. *Interior heat has, therefore, been a persistent fact, and a persistent factor in geologic dynamics.*

Moreover, these facts of upheaval and submergence, being universal, declare the universal fluidity of the great Earth-heart within. It is no circumscribed lake, as suggested by some. *It is one universal mass of excessively high temperature.*

When, however, the geologist concludes that fluidity will be reached at about the point indicated by his observed rate of augmentation of temperature, along a descending line, his con-

clusion is a *nonsequitur*, because he fails to recognize the changed conditions. As the line descends, *pressure increases directly as the line lengthens.* Now, one class of physicists claim that the increment of pressure is persistently superior to the increment of heat but these physicists fail to notice that, when high temperature and high pressure are simultaneously exerted on the same rock, the character of the rock is changed, so that *it becomes a far higher conductor of heat;* and that, therefore, *the incremental ratio for the heat very far exceeds the increment of pressure.* Hence fluidity is assured; but, this point once reached, another law comes in, viz.: *The conduction and interstitial radiation become extremely rapid through the fluid mass, so that the temperature of the fluid is uniform with the temperature of the entire nucleus,* and therefore *no further augmentation can take place;* but the ratio of pressure augmentation does not change. So that the increasing pressure soon overtakes the expanding power of the maximum heat, passes its limits, and solidifies all the nucleus within this limit.

An ideal section through the Earth's centre will, therefore, show the following:

First, an outer solid envelope.

Second, a semifluid envelope.

Third, a fluid envelope.

Fourth, a semifluid envelope.

Fifth, a solid nucleus.

No. 1 results from reduced temperature alone.

No. 2 results from pressure and a temperature not quite sufficient for liquefaction.

No. 3 results from a temperature sufficiently high to liquefy it under high pressure, and *is the maximum temperature.*

No. 4 results from the increase of pressure so as to be just overtaking the expansive power of the maximum temperature.

No. 5 results from a pressure so high as to overcome, completely, the expansive power of Earth's *maximum heat.*

At the centre of Earth the pressure, taking her general average, $5\frac{1}{2}$, water being unity, is 7,180,593,750 lbs. to the square foot—a pressure so enormous that no known substance could fuse beneath it at Earth's maximum temperature. Even hydrogen would be as hard as diamond at this maximum temperature of the internal nucleus.

In the foregoing I decline to fix the limits to any one of the five regions of the section, and content myself with showing that they must all find a place, and in precisely the order named, and for the reasons named.

All the above is strictly in accordance with observed facts, and as strictly in accordance with the laws of heat under pressure, both acting on the same matter at the same time.

I have strictly refrained from special theories, and thereby have avoided personalities.

SOURCES OF EARTH'S INTERNAL HEAT.

First. The source of the primary heat of this internal mass was the arrestment of the cosmic motion of the atoms, by centralization under the laws of gravity and rotary motion of the mass about Earth's axis. The free descent along the line of the axis must have resulted in an exceedingly high motion, and this motion was arrested at the centre, and in the growing nucleus, forming by their union.

Second. The heat, thus evolved, initiated chemical action among these atoms thus rushing in. These were the sources of the original nuclear heat.

When the mass was solidified, the heat was so high that very many of the superficial elements existed in their gaseous state only, forming an envelope around the central heated mass.

Finally, when this central mass had so far lost its fiery energy as to permit their descent in a liquid state, they descended in the order of their respective heat-endurance. Now, in their turn, they began to solidify, and form the outer crust.

Last of all, when the outer coating of this outer crust had reached the proper temperature, the water began to condense on the tops of all jutting peaks. Chemical action again set in as this water reached the alkine minerals. Here was another accession of heat.

In due time Earth became productive of living organisms. Water began to tear down the incipient mountain ridges, carry the debris down into the young ocean, and there form the sedimentary rocks. The thin crust frequently bent beneath their accumulating weight, and brought these half-formed rocks within the influence of this internal heat. Chemical action again, to a greater or less degree, modified them, and they were hardened into rocks.

Finally, the sun burst through the primeval shroud, or swaddlings of the new-born Earth, and began to lend its heat, to warm up the tender young bosom of Earth, and to fecundate her developing powers. Ever since that beginning, the sun has not failed for an instant, to pour in his genial warmth over some portion of Earth's surface. This warmth, in the form of organic bodies, has constantly been sinking into the same surface; and, though we take little note of it, this amounts to a vast quantity, in geologic ages.

I believe the foregoing is a fair summary of the case I undertook to investigate. It is only a summary.

ON SOME INTERESTING DERIVATIONS OF MINERAL NAMES.[1]

BY F. M. ENDLICH.

IN bestowing a name upon any hitherto unknown substance, two factors mainly contribute to determine its character: The circumstances attending the discovery, and the facts which have become known in relation to such substance. The basis upon which the new name has been formed may, in a general way, afford an indication of the scientific standard of its sponsor or of the period during which it became known.

Probably the first thought which the sight of a new mineral, for instance, may occasion, will refer to its geographical origin or physical appearance. The second question might, appropriately, refer to its composition; the third, to special characteristics and to its uses. We find, in point of fact, that a number of minerals were named by

[1] As any dissertation upon a subject like the derivation of mineral names must, of necessity, largely be a compilation, I have refrained from making citations which would uselessly cumber the article. I have principally utilized the publications of Theophrastus, Dioscorides, Pliny, Agricola, Beudant, Cæsius, J. D. Dana, Domeyko, Estner, Gessner, v. Kobell, Linnæus, Matthesius, Naumann, Pape, Quenstedt, Wallerius, Weigand, and Werner, besides various lexicographic and poetical works. The manner in which I have presented the subject is essentially original, and a number of suggestions have been introduced which may throw light upon some doubtful points or furnish hints for further elaboration.—E.

the ancients from the localities whence they were obtained, and this practice has been imitated with pious fervor during the last half century.

While the method of commemorating the name of the place which furnished the first specimens of any given species has certain advantages, philological as well as mnemonic, the nomenclature may thereby be rendered somewhat unwieldy, as *Nertschinskite*, *Herrengrundite*, *Guanajuatite*, and many others can testify. Similar in causal origin, but admixed with a certain spirit of appreciative courtesy, are those names which are derived from individual patronymics. Many scientific men, discoverers of new compounds, friends of mineralogists and chemists, and some persons of political rather than scientific prominence, have been immortalized by the bestowal of their names upon sound mineral species. Convenient and graceful as this mode of recognizing the services or merits of others may be, it is open to the same objections that apply to the use of geographical names, in that the burden of carrying words like *Macfarlanite*, *Schwarzembergite*, *Zepharovitchite*, and many others, is nearly as depressing as that imposed by the more recent terminology of organic chemistry.

A system of forming names from some physical characteristic is, perhaps, not more rational than the preceding; but it produces less bizzarre results, is apt to convey valuable hints, and tends to cause a desirable mental association of external features with the word designating the species. Thus, *Antholite*, contr. Gr. *ἀνθος*, flower, and *λιθος*, stone; *Asbolite*, der. Gr. *ἀσβολη*, soot, or *Xanthoconite*, contr. Gr. *ξανθος*, yellow, and *κονις*, dust, furnish a brief description of certain leading, immediately apparent individualities of the minerals. Other properties, which may not be patent at first sight, give rise to names like *Graphite*, der. Gr. *γραφω*, I write; *Heliotrope*, contr. Gr. *ἡλιος*, sun, and *τρεπω*, I turn, the name given by Pliny to a variegated jasper, as he found that its red blotches and bands seemed to increase in size and brilliancy when held under water, in the rays of the sun.[1]

A concise review of the most prominent physical attributes of minerals show the following to have influenced the formation of mineral names in a marked degree:

[1] "Causa nominis, quoniam delecta in vas aque fulgorem solis accidentem percussa sanguineo mutat." Pliny, A.D. 70. Venice, 1557.

FORM has produced *Stylotypite*, contr. Gr. *στυλος*, column, and *τυπος*, form; *Diagonite*, der. Gr. *διαγωνως*, angular; and many others.

WEIGHT is indicated by *Barite*, der. Gr. *βαρυς*, heavy; *Tungstite*, contr. Sw. *tung*, heavy, and *sten*, stone; and others.

COLOR is a marked feature, duly recognized by names like *Cyanite*, der. Gr. *κυανος*, sky-blue; *Ruby*, der. L. *rubeus*, red; *Polychroilite*, contr. Gr. *πολυς*, many, *χροια*, color, and *λιθος*, stone; and many others.

LUSTRE is referred to *Lamprophanite*, contr. Gr. *λαμπρος*, shining, and *φαινω*, I appear; and many others. Light and touch alone will acquaint the observer with the special properties, but further examination will reveal others of equal importance.

STRUCTURE is alluded to by a name like *Fibroferrite*, contr. L. *fibra*, fibre, and *ferrum*, iron; and others.

FRACTURE is referred to in *Scolopsite*, der. Gr. *σκολοψ*, a splinter; and many others.

CLEAVAGE is of value in specific description and identification, as is testified to by names like *Euclasite*, contr. Gr. *εὐ*, well-easily, and *κλαω*, I cleave; *Loxoclase*, contr. Gr. *λοξος*, oblique, and *κλαω*, I cleave; and many others.

ODOR, TASTE, ELECTRICAL, CRYSTALLOGRAPHIC, OPTICAL, and other properties are duly utilized in the formation of distinctive names. After the physical constitution of a substance has been exhausted in furnishing points for discrimination, the most prolific field to turn to is that of chemical exploration. Under the application simply of heat, many minerals are curiously transformed. Often the changes exhibited are highly characteristic, and can well be utilized for taxonomic purposes. *Scolecite*, der. Gr. *σκωλεξ*, a worm, describes a mineral which exfoliates into contorted, worm-like forms upon heating; *Melanophlogite*, contr. Gr. *μελας*, black and *φλογιστος*, burned, refers to a marked change of color under the influence of heat; *Zeolite*, der. Gr. *ζεω*, I boil, designates an important group of allied minerals which bubble and intumesce upon fusion; *Euosmite*, contr. Gr. *εὐ*, well, agreeable, and *ὀσμη* odor, is the name of a species which emits a pleasant odor when heated, contrary to the general rule.

The chemical composition of a mineral is of the highest importance, and valuable hints as to its nature can be conveyed by the

name. *Stercorite*, der. L. *stercus*, manure; *Arseniosiderite*, contr. Gr. ἀρσενικον, arsenic, and σιδηρος, iron, and many others, convey useful information as to component parts. Every now and then the investigator finds himself somewhat baffled by the constitution of the mineral, or he obtains unforeseen results. Nordenskiöld met a case of this kind by coining the name *Thaumasite*, der. Gr. θαυμαζω, I am surprised; and Ekeberg by forming *Automolite*, der. Gr. αὐτομολος, deserter, in allusion to the fact that his specimen had deserted other species to which its composition was supposed to be allied. *Æschynite*, der. Gr. αἰσχυνη, shame, records Berzelius' protest against the inability of chemical science of that day (1828) to separate zirconic and titanic oxides. Peculiarities in chemical behaviour also find expression in the name: *Tachhydrite*, contr. Gr. ταχυς, quickly, and ὑδωρ, water, refers to the rapid deliquescence of the substance upon exposure to the air.

In some instances both physical and chemical properties which are especially noticeable, may be indicated by the name: *Sideroschisolite*, contr. Gr. σιδηρος, iron, σχιστος, split, and λιθος, stone, is the name of a ferric silicate with perfect cleavage; *Chalcophyllite*, contr. Gr. χαλκος, copper, and φυλλον, leaf, alludes to the foliated structure of a cupriferous mineral.

The Greek language, singularly flexible and rich in clear definitions, has furnished the majority of descriptive mineral names; Latin has been used more sparingly. Examples are not wanting where Greek and Latin have been combined in the same word, although this practice is to be deprecated: *Pyraurite*, contr. Gr. πυρ, fire, and L. *aurum*, gold ("molten gold"); *Cupraphrite*, contr. L. *cuprum*, copper, and Gr. ἀφρος, foam, is a literal rendition of the prior G. *Kupferschaum*. Languages of our own day have likewise yielded their quota to the list of mineral names: *Muromontite*, contr. L. *murus*, wall, and *mons*, mountain, is the Latinized form of G. *Mauersberg*, where the mineral was found; *Leucopetrite*, contr. Gr. λευκος, white, and πετρα, cliff, translates the G. *Weissenfels*. The G. *Olivenerz* of Werner, 1789, has become *Olivenite*, on account of its color (G. *Olivin*), and the popular term of *Carminespar* has evolved into *Carminite*.

The successful attainment of uniformity in mineralogical nomenclature is largely due to the rigid stand taken by Professor James D. Dana, the eminent American mineralogist. But a few centuries since, all matters pertaining to chemistry and mineralogy were in the

hands of alchemists, apothecaries, and a few doctors of medicine. For the production and application of meaningless names, these gentlemen are to be commended. The principal metals were called by the names of the "heavenly bodies," as Chaucer has rhymed it:

> "Sol gold is, and Luna silver we threpe;
> Mars iren, Mercurie quicksilver we clepe."

Others were endowed with terms like *lupus metallorum*, wolf among metals, for *antimony; diabolus metallorum*, the devil among metals, for *tin; spuma lupi*, wolf's spittle, for *wolfram*, etc. On the other hand, we are indebted to the alchemists for many chemical terms which are now indispensible—*e.g.*, *alcohol, alkali, crucible*, and many others. The influence of ancient Arabic magic and occult science is plainly discernible in the Oriental source whence the alchemists chose their names for various substances. By so doing they removed the comprehension of their terminology far beyond the reach of laymen, and even of many learned philologists and ecclesiastics, and added to the attractive mystery which enveloped their labors. Linnæus, about 1730 to 1740, attempted to introduce binomial nomenclature for minerals; but the science was not ripe for it in his day. His efforts were in the right direction, tending, as they did, towards systematic classification; but the means were not at his hand to use proper discrimination. The material was too crude; the analytical knowledge too insignificant. To-day some of his names cause a smile—*e.g.* (Edition Gmelin, 1773), his genus *Silex* contains the species *Silex achates*, agate, and the subspecies *Achates arenomorphos*, "with drawings of constellations;" *A. zoomorphos*, "with drawings of animals;" *A. technomorphos*, "with drawings which the imagination transmutes into works of art," etc.

Few of the mineral names given by the alchemists have survived in their original application, but their researches have enriched our fund of available words. Quicksilver (*mercurius vivus*) has been handed down unchanged; but *Marcasite*, for instance, now designates a compound of sulphur and iron, while it was used for bismuth (*marcasita argentea*) originally. Besides the planets, mythological deities have been called upon to furnish names for the ever-growing list of mineral compounds. *Thorite* perpetuates the name of the mighty Scandinavian god, the son of all-powerful Odin and the Earth.

In addition to the features which have been touched upon above, as affording especially noticeable suggestions for the construction of mineral names, there are a few others of sufficient prominence to command attention.

MODE OF OCCURRENCE is often associated with the genesis of the substance; hence of importance. *Limnite*, der. Gr. *λιμνη*, marsh,, alludes to the origin and formation of *bog-ore*. *Alunogen*, a curious cross between Fr. *alun*, alum, and Gr. *γενναω*, I produce, refers to the generation of the mineral from decomposing *Pyrite*.

RESEMBLANCE to other species may provoke errors of identification, and gives rise to names like Apatite, der. Gr. *ἀπαταω*, I deceive, on account of its resemblance to *Aquamarine*.

COMPARISON with allied compounds is expressed in names like *Miargyrite*, contr. Gr. *μειων*, less, and *ἀργυρος*, silver, whereby the fact is indicated that this mineral carries less silver than other closely related species.

MIMICRY of natural objects is readily perceived and made the basis for a name. Thus, *Ophite*, der. Gr. *ὀφιτης*, snake, is applied to some varieties of *Serpentine* (snake-stone) because of snake-like markings. *Botryogen*, contr. Gr. *βοτρυς*, a bunch of grapes, and *γενναω*, I produce, explains itself.

DECEPTION is recognized in minerals whose occurrence or genesis would lead to the inference of a different composition than they possess in reality. *Sphalerite*, der. Gr. *σφαλερος*, treacherous, was so named because it carried very little silver, though generally associated with argentiferous ores.

THE USES to which a mineral may be put also furnish hints for its name. *Agalmatolite*, contr. Gr. *ἀγαλμα*, picture, and *λιθος*, stone, is the material utilized by the Chinese in carving out numerous small objects.

A rather pathetic appeal reaches us through the name of one of Breithaupt's species: *Monacite*, der. Gr. *μοναζω*, I am alone. It is of very rare occurrence.

Apart from the mineral names which have been formed for the purpose of expressing a definite idea, there are some which are of interest on account of their origin, their philological relations, or their application; others claim attention by virtue of the mutations they have undergone, or by their associations.

1. A few names are of obscure origin, and their etymology is imperfect:

ZINCITE.—The O. H. G. form of *zincho, zinco,* may, perhaps, be perpetuated in the M. H. G. *zinck* (Weigand) and H. G. *Zink,* Sw. *zink. Zincho* signifies a white spot in the eye. The origin of the word is by no means clear, but is probably German or Indo-German. Apparently it is related to G. *Zinn.* (See *Stannite.*)

The metal zinc seems to have been first described by Paracelsus, about 1528. N. L. *zincum.*

QUARTZ, the name of the most widely-distributed of all minerals, suddenly appears in M. H. G. as *quarz,* with a plural *querze* which latter it retains until the middle of the sixteenth century N. L. *quarzum* (Agricola, 1546); *quartzum* (Wallerius, 1747). No older root seems to be known. G. *Warze, Gewarz,* warty excrescence, has been suggested. The form *Quertz* occurs as late as 1743 (Bergwerck's *Lexicon*), and *Quärtzel* at that time signified a chip of rock, or one which flew into the miner's eye. The word probably originated among German miners, as the mineral is one which might readily escape special notice, unless encountered in the form of veins. *Quartz-crystals* were known as *Kristalle* in M. H. G.

It seems possible that *quartz* should be related to Engl. *quarry,* to L. *quadrus,* G. *quader,* Sw. *quatersten,* and other words pertaining to the cutting of blocks of stone—*e.g.,* L. *quadratarius,* stone-cutter.

M. and N. L. *quartatio,* separation of precious metals from other minerals, might have been corrupted into *quarts* or *quartz,* in allusion to the fact that quartz, when it forms the matrix, generally admits of a sharp definition of "ore" or "metal" and "stone."

ANTIMONY.—It is a difficult matter to trace the origin of this word satisfactorily. We know that the classical Greeks and other ancient nations possessed the antimonial sulphide (*Stibnite*), which was extensively used for cosmetic purposes. The substance was powdered and applied to eyelids, eyebrows, and underneath the eyes, with the intention of making the latter seem larger and more brilliant. This classical custom has survived to the present time.

By the Greeks the word στιμμι, or στιβι, was used to designate the mineral employed. The word is not of Greek origin; possibly Egyptian, probably Arabic. From this the Romans borrowed *stibnum,* which has remained the Latin name of the metallic element to this day. Metallic antimony, though known to the ancients, was

first described, as to its properties, by Basil Valentine, near the year 1400.

Antimony, as a word, fails to comply with the Gr. *στιμμι* in all but the *tim*. That this should be sufficient to establish a connection cannot be claimed, but it indicates that both names may well have a common origin. It is possible that the first syllable, *an*, may be a modification of the Ar. article *al*, in which case the reference of the word to an Arabic origin would seem justified. An old Arabic name for *Stibnite* is *al-kohl* (whence our *alcohol*); but as this seems to refer to the powder, rather than to the crude mineral or metal, there may have been another root. The Ar. *al-ithmidun* is regarded as the source of antimony, the latter being a rather exaggerated corruption of the former. Another derivation brings it from the Ar. *athimar*, the name of the metal. (Const. Africanus, 1100.)

A forced derivation is obtained from Gr. *ἀντι*, against, and M. L. *monachos*, monks. Basil Valentin, the monk, fed some antimonial compound to his pigs, and they grew fat upon it. He tried the same dose upon his cloister brethren, and they died: hence the supposed origin of the name. It remains a coïncident that the French word for antimony introduces an *i* in *antimoine*, and that Fr. *moine* means monk.

Bismuth.—The origin of this word is not very clear. It was first used in Germany in the later middle ages. A common explanation assigns it to O. H. G. *wesemot*, contr. *wese*, meadow, and *mot*, damp ground, swamp; but, aside from the similarity of sound, there seems to be no relation between the two words.

Another root has been claimed in the H. G. word *Wiese*, meadow, as some old writers claim that the colors which the metal assumes upon cooling after fusion are varied and beautiful as those of flowers on a meadow (sixteenth century). The metal is white, and often assumes iridescent colors after melting.

During the sixteenth century German writers speak of it as *Bismut*, *Bissmuth*, *Wyssmuth*, and *Wissmuth*. At the same period its Latin name was *bisemutum* (Agricola, 1546). This latter may be merely an amplification of the German term, or it may be composed of the L. words *bis*, twice, and *emuto*, I change, in allusion to the crystalline and color changes undergone upon fusion. About 1400 the word was *bismuthum*.

A more plausible explanation of its origin lies in the derivation from M. H. G. *wiss* or *wyss*, white, the color of the metal. There

are traces of an O. G. root *mut*, which refers to ground, earth, and, in Swedish, seems to indicate ore, mine. From this root the second syllable of the word may be derived. If the name was given by miners—and there is every reason to suppose that it was—then it was, in all probability, a descriptive term, denoting either appearance or some peculiar property. The above derivation would, therefore, determine the meaning of the word as *white-ore*, or some kindred term. Sw. *vismut;* later, *bismut.* The change from *w* or *v* to initial *b* is due to Latinization.

2. Besides the names of decidedly dark origin, there are some which have changed considerably, in their journeys from nation to nation, through the course of centuries. It is interesting to note in these, as well as in other instances, that the words have generally reached Scandinavia through Germany, England through France.

EMERALD is the modified form of Sansk. *marakata* and *samaraka.* In Pers. the latter becomes *zamarrad;* in Ar., *zamamth;* in Gr., *μαραγθος* and *σμαραγδος*, with the verb *σμαραγδειν* L., *lucere*, to shine brightly. In all of these forms, as well as in the L. *smaragdus*, the initial *s*-sound and the final *d*-sound have been preserved.

The Gr. and L. form has persisted in the G. and Sw. *Smaragd;* in It. it is changed to *esmeraldo;* Sp., to *esmeralda.* O. Fr. retained the prefixed *e* and the *l*, using the word *esmeraulde;* subsequently this was modified into *emeraude.* Our English name follows the latter closely in O. Engl. *emeraud* and *emeraulde*, but has retained the *l* in *emerald:*

. . . . . "the semes echon
Was set with emerauds one and one."

—*Chaucer*, 1340–1400.

and, later:

"Would emulate the emeraulde-like grass."

—*Stirling*, 1614.

Σμαραγθος was mentioned by Herodotos, about 450 B.C. Usually the name was applied to varieties of aquamarine, rather than to the emerald, although the ancients were familiar with the latter.

. . . . . "*σμαραγδου λιθου λαμποντος τας νυκτας μεγαθος.*"

—*Herodotos*, II, 446.

Pliny describes it as surpassing everything that exhibited green color in the loveliness of its shade.

EMERY, although so near *emerald* in sound, has a totally different origin. Its Gr. ancestor is *θμυρις* or *θμηρις*, der. Gr. *θμυριζειν*, to polish by rubbing. Dioscorides uses *θμιρις*.

In H. G. the word resembles the Greek phonetically—*Schmirgel, Schmergel*, or *Smirgel;* Sw. *smergel*. In It. the L. *smiris* changed to *smeriglio;* N. L., *smeriglo* (1602), *smeriglius, smirillus* (1610); Sp., *esmeril;* Fr., *emeril*, later *emeri*—whence Engl. *emery*.

It will be observed that a number of words prefix an *e* in French and Spanish. This is probably due to the use of the respective masculine articles *le* and *el*. Thus, It. *smeriglio* becomes *le smeril*, and subsequently *l'esmeril* or *l'emeril*. In Sp. the article *el* is prefixed and the *l* finally eliminated. Changes of gender are of rather frequent occurrence in the history of mineralogical nomenclature, so that French or Spanish names which show an initial *e* but are now feminine may well have been masculine at some early period.

CALAMINE has often been accredited to Gr. *χαλαμος*, L. *calamus* reed (Agricola, 1540), a name which might appropriately be given to some varieties on account of their structure. This derivation is all the more seductive, as a genus of plants, *Calamites*, has the same ancestry. The name, however, seems to be due to Gr. *καδμεια*, L. *cadmia*, G. *Galmei*.

Gr. *καδμεια*, or *καθμια*, is used by Dioscorides, about A.D. 30, in writing of a mineral, and was supposed to have been derived from the legendary *Καδμος*, a Phœnician, who came to Greece and first introduced smelting there; later by Pliny and others, in the form of L. *cadmia*.[1] In It. it remained *cadmia*, but in the transition from It. to Sp. and G. the *d* changed to *l*, as is frequently the case, and we find Sp. *calamina*, Fr. *calamine*. Alb. Magnus uses *lapis calaminaris* (1280). G. *calmei* appeared in the beginning of the sixteenth century; not long after, the initial *c* of *calmei* was replaced by the H. G. *g*, producing *galmey* (*Cadmia fossilis*, Gessner, 1565); later, *Galmei;* Sw., *gallmeja* (1750). The name was rather indiscriminately applied as "*Cadmia metallica cinerea*," in the sense of "*ein natürlicher, grawer kobelt*" (a natural grey cobalt), shows (Gessner, 1565).[2]

[1] *Namque; ipse lapis, ex quo fit aes, cadmia vocatur.*"

[2] A. Caesalpinus, Aretinus, 1602, says: "Calaminam, seu lapidem Calaminarem, vulgo, Giallaminam, ... Arabes Climian vocant."

GARNET.—From the color and size of the grains—in which latter form garnets were first found—they were originally compared to the seeds of the pomegranate (*malum granatum*), and received the name *lapis granatus* therefrom (cfr. Magnus, about 1280). L. *granum*, grain, is the root, although *granatus*, having the meaning of grains or seeds, was used by Cato about 200 B.C. In G. this has perpetuated itself as *Granat*, from M. H. G. to the present time; in It., *granato;* Sp., *granate;* Fr., as *grénat*. Transposition of the letters forming Fr. *grénat* furnishes the Engl. *garnet*.

It is curious to note that, while the Engl. compound word *pomegranate* (G. *Granat-apfel*) retains the original relative position of *gr*, this has been changed in Engl. *garnet*.

ORPIMENT is a corruption of L. *auripigmentum*, contr. L. *aurum*, gold, and *pigmentum* (from L. *pingere*, to paint), color, used by Pliny, about A.D. 70. O. H. G. *orgimint*, M. H. G. *orgemint, orperment, opriment, opirment*, prepared the way for H. G. *Operment*, in which the *r* of aurum has been entirely dropped and one inserted after the *p*. Sp. *oropiment*, It., Fr. and Engl. retain the *r* in *orpimento* and *orpiment:*

> "The first spirit quicksilver cleped is,
> The second orpiment."
>
> —*Chaucer*, 1340–1400.

ZIRCON.—The derivation of this name is somewhat peculiar. For many years the Island of Ceylon furnished gems and half gems. Some of the latter were utilized to imitate their more valuable associates. Such were called *jargon* in French.[1] Among them were some colorless crystals, and others of yellow and reddish shades, which turned white and clear under the application of heat. These were especially desirable for the imitation of diamond, and to them the name *jargon* finally attached itself almost exclusively. In the middle of the last century Linnæus describes this mineral under the name of *jargon* in such a manner that its identity can be established. He states (Ed. Gmelin, 1777) that the (presumably German) jewelers' name for reddish jargons which turned colorless in the fire was "*Cerkonier*" (*Cerkon*), and that they exhibited the fire and lustre of the poorer quality of diamonds. In 1783,

[1] Linnæus mentions Fr. *jargon* and It. *sargone*, yellow diamonds—the inferior class—whence the name may have been transferred to the stones which counterfeited the valuable gem."

Werner, the famous mineralogist of Freiberg, produced the name *Zirkon* for this mineral. In ordinary parlance, the *zircon* is known as *jargon* in France to-day, so that the accepted scientific name is to be regarded as a corruption of the popular one.

Jargon, in the above acceptation, means counterfeit, wrong presentment, but the word is now more particularly used in the sense of *gibberish*. The remote origin of jargon may connect it with Gr. γαργαριζω, I gargle—make a noise in the throat—and L. *garrio*, chattering (whence Engl. *garrulous*), gossiping. In It. it has changed to *gergone* and *giargone* (de Boot, 1636); Sp., *jerga, jerigonza*; Fr., *jargon*; O. Engl., *jergon*; Engl., *jargon* (der. A.-Sax. *girran*, chattering [?]).

> " He was al coltish, ful of ragerie,
> And full of jergon as a flecked pie."
>
> —*Chaucer*, 1340–1400.

> " Their mystic cabals and jargones."
>
> —*Butler*, 1682.

In these instances the meaning of jargon is somewhat different from that of to-day.

(To be concluded.)

ABBREVIATIONS.

A. D.,	Anno Domini, in the year of our Lord.	M.H.G.,	Middle-High German, A. D. 1150 to 1500 (Weigand).
a. m. o.,	and many others.	M. L.,	Middle Latin, from classical period to about A. D. 1300.
a. o.,	and others.	N. L.,	New-Latin, since A. D. 1300.
Ar.,	Arabic.	obs.,	obsolete.
A. Sax.,	Anglo-Saxon.	O.Engl.,	Old English, prior to about A. D. 1550.
B. C.,	Before Christ.	O. Fr.,	Old French.
contr.,	contraction of.	O. G.,	Old German, A. D. 500 to 1000.
D.,	Dutch.	O.H.G.,	Old-High German, A. D. 700 to 1150 (Weigand).
der.,	derived from.	Pers.,	Persian.
e. g.,	exempli gratia, for instance.	q.v.,	quid vide, which see.
Engl.,	English.	Sansk.,	Sanskrit.
Fr.,	French.	Sp.,	Spanish.
G.,	German.	Sw.,	Swedish.
Gr.,	Greek.	=	synonymous with.
Heb.,	Hebrew.		
H. G.,	High German. Since A. D. 1500.		
Icel.,	Icelandic.		
i. e.,	id est, that is.		
It.,	Italian.		
L.,	Latin (classical).		

SEA-SIDE STUDY ON THE COAST OF CALIFORNIA.

BY J. WALTER FEWKES.

WITH the increased facilities for travel, the number of Eastern naturalists who visit California to collect marine animals with dredge and dip-net, will also increase. Those who are interested in the marine zoölogy of the Pacific Ocean will seek advice of those who have already studied there, as to the best place to carry on their work with profit and with least loss of time. To such the experiences of the author and his convictions as to a good place to prosecute this kind of work on the California coast may not be without interest.

A second and most important object in writing this paper is a plea for the establishment on the Pacific coast of a marine laboratory, where biological research of all kinds shall be carried on.

It is a great pleasure to a marine zoölogist to pull the dredge or drag the Müller's net[1] in waters where these implements have never been used. It is a source of real satisfaction to study a marine fauna in which a majority of the animals captured are new to science, and one may be pardoned if he speaks with enthusiasm of the results of such study.

Such places are many, and opportunities of this kind not so rare that naturalists are obliged to enter upon long journeys to reach them. Even upon the coast of New England where marine zoölogy has been cultivated for many years, the work can hardly be said to have more than begun, while great groups of marine animals have hardly been identified. A preliminary study, however, has been made, and, thanks to the researches of our naturalists whose names, known to all zoölogists, it is not necessary to mention, the facies of our New England marine fauna is known.

When, however, we turn to the western shores of North America, to the coast of California, Oregon and Washington Territory, we find a shore where this study is yet in the first stages of growth, for

[1] The net used in surface fishing. So called because so successfully used by the great naturalist, Johannes Müller.

here the dredge has been but little used, and the revelations of the Müller's net are almost unknown.

The marine animals of the Atlantic have been for a long time the continuous study of marine zoölogists. Those of the bays and seas of Europe and of the Eastern waters of the United States have been so sedulously investigated that it may be said that almost our whole knowledge of animals which live upon the surface of the ocean, is derived from this source. The Pacific Ocean, from its remoteness from centers of zoölogical activity or other causes, is almost wholly unexplored, and while good beginnings have already been made, even the facies of the surface fauna of the Eastern Pacific is practically unknown.

The coast of California, throughout its great length, offers extraordinary advantages for a study of this department of marine zoölogy, and yet, with one or two exceptions, the use of the Müller's net, early introduced on the Atlantic waters of the United States by the elder Agassiz, and so successfully used for so many years by several naturalists, is unknown on a coast washed by the largest ocean on the globe. The use of dredge and net has a great future in the study of the marine fauna of California.

In the first phase of the study of the surface life of the ocean, the work was almost wholly the result of individual enterprise, unaided by government or university appropriations. Naturalists visited, during their vacations, the North Sea, Nice, Villa Franca, Naples, or Messina, accompanied by students, and in that way the foundations of this knowledge were laid. The work which they did has been the admiration of naturalists and their verdict forms a part of the history of science. But in this pioneer work the older naturalists had difficulties to contend with which one who visits the well-appointed stations which have arisen in later years on the Mediterranean, knows nothing of. The places which offer the best localities for collecting were not known, practical fishermen had to be shown the animals which were wanted and how to collect them. In most cases the naturalist himself had to spend many hours on the water collecting, and precious time was used for what might have been done by others. The naturalist was investigator and collector, and his laboratory, oftentimes the room in which he lived, or some place poorly lighted and little fitted for his work. While the combination of collector and investigator in one and the same person [1]

[1] I know of no more absurd position than that of the closet naturalist who despises the collector, or of the anatomist or histologist who belittles

is sometimes an advantage, it is true that much work can oftentimes really be accomplished if these two functions are performed by specialists. In no short time there arose in Europe, in the best localities on the coast, permanent laboratories with all appliances for continuous work. It was no longer necessary for the investigator to explore the coast to find out where the best collecting grounds are, or to make arrangements with fishermen and educate them for the work.

He was no longer obliged to spend months in search of some animal whose favorite habitat and breeding place must be discovered before research upon their anatomy, embryology, or histology, could be carried on, but all these difficulties were reduced to a minimum. Well-endowed stations with equipments have arisen. Continuous observations in the same place have taught when and how certain animals can best be found; and the naturalist now economized time and money, while by working in the established laboratories he finds himself associated with others interested in the same work. Much praise must be given to the pioneers in this study, and the younger school of naturalists, from the vantage ground which they occupy, are apt to overlook the difficulties which those before them encountered.

On the Atlantic coast of the United States we have passed or are passing into a second stage in the development of the study of marine zoölogy. While the older American zoölogists in their earlier days sought the shore with no help from state or college, we now have well-equipped laboratories bringing many other advantages. The contributions to science made by the U. S. Fish Commission, Mr. Agassiz' Newport Marine Laboratory, and the Chesapeake Marine Laboratory, tell of the harvest which may come from the second stage in the development of marine research in America. While these stations have accomplished a great deal in carrying on the study, much is done every year by summer schools of natural history and by individual naturalists unconnected with any of these stations or schools. Professors of our colleges visit the shore with pupils, and in several instances have made extended investigations wholly independent of public or private marine laboratories. These efforts have much to recommend them, but are

the systematic zoölogist. It is, as suggested to me by a well-educated naturalist for whom I have great respect, like the hands of the clock saying to the pendulum, "I have no need of thee."

often hampered for resources, as they involve in many instances large outlays for boats, dredges, and fishermen. Moreover, some of the best localities for the study of marine zoölogy are visited by these private parties.

On the Pacific coast the study of marine zoölogy has entered upon the first phase of the development, but has not passed to the second. No marine station has yet been founded there. The naturalist who seeks those shores must himself discover the best place to work. He finds no fisherman familiar with his needs, and must educate them in the use of the dredge. In short, feels that he is veritably a pioneer, if he has in mind the use of the net and dredge. The delights and results of his work, however, are those which come to the first worker in a new field.

When I had decided to visit the California coast to study its marine fauna, the first information which I sought was where is the best place to get the best results in the shortest time? The first question which was asked local naturalists was, where is the best place for the study of marine zoölogy on the coast? I received in most cases no satisfactory answers, and perhaps I ought not to have expected them. Prominent marine zoölogists in Europe differ in their estimates of the value of localities on the Mediterranean as collecting places. Many say Villa Franca, others Naples, others Messina. On the coast of New England some of our prominent naturalists prefer Newport, others Wood's Holl, others Eastport. Every one has a preference, but it is a known fact that there are some places on our coast which no one recommends. The coast of California, however, has been so little studied that even the satisfaction of knowing the prominent places was not allowed, as I could find almost no one who had used the dredge. The first thing necessary there was a kind of geographical exploration to discover a good place for work.

It may be of advantage to others who have in mind a visit to the Pacific coast for work similar to that which I carried on to know the result of my experiences. I have used the dredge and Müller's net at Santa Barbara, and among the neighboring islands, at Port Harford, Santa Cruz and Monterey. I can recommend any of these places for this kind of work; but I prefer the Bay of Monterey, and think if ever a marine station is founded on the coast of California, no better site can be chosen north of Point Conception than on this beautiful bay. I am sanguine enough to hope that in

time two marine stations will arise on this coast, in which case the Bay of Monterey and either San Diego[1] or Santa Barbara might well be chosen.

There are several desiderata which influences the marine zoölogist in his choice of a working place upon any shore. The first, perhaps the most important one, is whether the collecting is good, whether there are many animals at the place recommended. This is an all important, but it is by no means the only question. Of what use is it to a naturalist if he can stand on a wharf and see a wealth of surface life float by and can get no boat to collect it? This might seem an absurd condition on the coast of New England where every coast hamlet has so many boats; but I have been in a considerable village on the coast of California where one or two large, undesirable boats were the only boat facilities of the place. In Santa Barbara, which has the reputation of being a boating place, you can count on your two hands the number of small boats for rent. Several conditions have brought about this result. In most places the wharf is built out from a beach on which the surf is continually breaking. There is no protection for boats, and the fondness of the New England coast people for the water is not known. Although so many strangers come to Santa Barbara, there are few pleasure boats and no skippers. Compare this condition with the wharfs, for instance, at Newport or Eastport.

It is not alone necessary for the marine zoölogist that he should have a good collecting ground and a boat, but he must be able to reach the coast easily. If he studies animals alive his laboratory must be on the shore, for pure water must be continually supplied, and the live animals of the fragile nature of many marine creatures cannot be carried for long distances without harm. It is best if his laboratory is as near as possible to the water. The New England fishing towns, many of which arose as fishing hamlets, lie upon the very shore, and accommodations are easily found to satisfy the naturalist's wants. That is not always the case, however, in towns which have originated like those of California. The holy fathers who were the founders of Santa Barbara and Santa Cruz did not look to the sea for a livelihood. The first settlers were not fisher-

[1] Unfortunately, circumstances prevented my spending any time at San Diego in the study of surface animals or in dredging. I confess my ignorance of its advantages, which from what I could learn from others and my own superficial examination of the neighboring coast, must be very great.

men, nor was commerce at first of great importance. As a result many of the coast towns are separated by some distance from the wharf or landing-place. One knows how much discomfort this may mean to a naturalist if he has trudged along over a mile from the wharf to the nearest house he could rent for a laboratory, with a water-bucket filled with the products of surface fishing by night, and if twice a day he has been obliged to replenish the water by a similar tramp. Time is lost which might be employed for work, and the naturalist cannot watch and take advantage of the ever changing conditions of the sea and wind if his workshop is a mile or more from his boat. The naturalist who studies ichthyology,[1] and who visits the fish markets when the fishermen return from their nets, does not feel these discomforts which the naturalist who must collect for himself has.

A good collecting-place, boats, and ready access to the water are three requisites in a choice of a good station for marine work. They are the great difficulties which the pioneers in marine zoölogy have always encountered. The naturalist who works in a well-equipped station, with trained fishermen for collectors, knows little of these difficulties. Until, however, a zoölogical station is founded on the coast of California these three things, unfortunately or fortunately, must have great influence in his choice of a working-place.

The Eastern zoölogist, who has worked on the Atlantic, encounters several physical characteristics on the coast which are new to him. The absence of those nooks and indentations of the coast, pockets in which floating life is driven by the currents and winds, is a marked feature of the coast line. Many of the harbors are open roadsteads upon which a surf is continually breaking. While this feature is in some respects a disadvantage, it is in others an advantage.

Along the coast in many places, as at Santa Barbara, a zone of floating kelp undoubtedly prevents many floating animals from being washed to the shore. This kelp extends for miles along the coast, and it is only where the bottom sinks immediately to a great

[1] In this article I have considered more especially the needs of the student of the marine invertebrated animals, as the largest share of oceanic life belongs to these groups. In many instances it will be found that the needs of the ichthyologist are very different. They have little to do with dredging, but the student of the embryology of marine fishes and their younger stages will appreciate what is desired in work with the Müller's net.

depth near the shore that it is absent. While it may shut out effectually many floating things from the neighborhood of the wharf, it shelters in its fronds many others; while the root-like attachments to the rocks harbor many interesting animals. Between the zone of kelp and the shore was not found to be a profitable dredging-ground. The interval appears to be filled with decaying fragments of the kelp, and the dredge comes up filled with this debris. Dredging in the belt of the kelp itself is impossible.

The best dredging at Santa Barbara is in the channel about four miles outside the outer border of the kelp. The rocks in places entangle and catch the dredge, and the bottom is, except in one or two places, very rocky. Off Punta del Castillo, near Santa Barbara, there is some good ground for dredging, but it is hard to pull the dredge on account of the many submarine rocks. From Santa Barbara across the channel to the Santa Barbara Island, there are many rocks, but the dredging is good in places. The vicinity of Carpenteria is the best place of all about Santa Barbara for dredging.

The island of Santa Cruz,[1] one of the most beautiful islands of the Santa Barbara group, offers fine surface collecting. The dredging is difficult on account of the many submarine rocks and the depth of the water. To one visiting the island for zoölogical study no better anchorage can be found than a small cañon resorted to by otter hunters near Punta Diablo. The shore collecting on the beach at Santa Barbara is poor. At Punta del Castillo many interesting animals were found.

Santa Barbara on the whole offers good facilities for the study of marine zoölogy. The fauna of the shore is not rich, but it is varied, and that of the neighboring islands is all that could be desired. The surface fauna of the Santa Barbara channel is very rich and dredging in it is excellent. I do not believe the shore at Santa Barbara can compare with that to the south by Del Mar and San Diego as a collecting place for the naturalist, but the dredging is good and the surface collecting all that could be wished.

[1] Especial interest is attached to a study of this island from the curious distribution and character of the flora as compared with that of the main land. This island, continental to all outward appearances, has a more peculiar flora than the Bermudas, although they are only a little over twenty miles from the shore, while the Bermudas are five hundred. No more interesting problems can be studied in regard to the geographical distribution of animals than the character of the life of the islands near Santa Barbara.

In order to study the conformation of the coast of California between Santa Barbara and the Bay of Monterey, and to form a judgment of the advantages of the several ports for natural history work, I took one of the smaller steamers of the Pacific Navigation Company, which touches at the several landings. I did not dredge in all these places and my judgments may be more or less hastily made. They are thought to be of some worth.

Gaviota seems illy adapted for surface work, as I am told that a stiff breeze from the mountain pass almost continually ruffles the sea. As we approached the wharf at about nightfall a cold boisterous wind from the mountains seemed to prevent any night work with the net.

Port Harford seemed made on purpose for the study of marine zoölogy. The wharf is well situated for landing with treasures, and the hotel is contiguous to the shore. Small islands and rocks of ready access afford good collecting ground for litoral animals. Many floating animals were observed in the neighborhood of the landing.

San Simeon and Cayucos are open roadsteads with few fishermen, and seem little calculated for the purposes of the naturalist.

The little hamlet of El Moro lies favorably for work, but at present the steamers do not land there. These three places would be interesting places to carry on marine research, as few animals have been recorded from their neighborhood, and they are rarely visited by naturalists.

The coastline from Cayucos to Monterey is one series of lofty cliffs which have been little explored. No villages large enough to necessitate the landing of the steamers exist, and although there is probably a multitudious marine life in the water, no point seems adapted at present for the study without great inconveniences. It would be impossible to get boats and fishermen on this unknown coast. San Simeon is a dairy town and few fishermen are found there, although there is an easy communication with San Francisco and other prominent ports on the Pacific, by means of the Pacific Steamship Company.

Santa Cruz presents many conditions which render it a good place for the marine zoölogist to work. There are many fishermen and boats can be had at reasonable rates. It has good hotels and boarding-houses contiguous to the landing-places. There is a good sandy beach and near by rocky cliffs both with characteristic life. The

dredging is good. The neighboring town, Soquel, when there are many fishermen, presents many facilities for the naturalist.

Collecting on the piles of the wharf is not as good as at Santa Barbara. There is no belt of kelp forming a thick zone shutting out the floating genera from the shore. The phosphorescence is at times superb, but surface collecting in the afternoon was found to be next to impossible. The beach is more sheltered than that of Santa Barbara, but it rarely happens that the surf does not break on the shore. Sheltered caves or natural pockets in which floating life are caught are rare.

Taken all in all, Monterey [1] is one of the best places on the coast of California for a naturalist to station himself for a study of the marine life of the Pacific. It may not be the best, but experience has taught me that it is *one* of the best, and a visit there by a naturalist will be amply repaid by novelties if his object be research.

The surface fauna is rich and there is good dredging. There are boats of all sizes and many fishermen. The city lies near the shore and one is not forced to waste time in reaching the wharf from the hotel. The means of communication with the outside world are easy. I find, on reference to my note book, that many of my choicest specimens came from this locality.

Stimpson found the bay of San Francisco nearly barren of a varied marine life except at its entrance. This condition he ascribed to the admixture with its water of the turbid flood of two large rivers and the small size of the gate which admits the clear waters of the ocean. A short and somewhat superficial examination of the resources of the bay lead me to a somewhat similar conclusion, yet I find the entrance to the bay one of the best places for floating animal life. From the wharf several very interesting floating animals were taken, and there is evidence that the marine zoölogist will find plenty to occupy his attention within a short distance from the city. A great advantage of San Francisco as the site for zoölogical work is the vicinity to scientific libraries and the number of fishermen and fishing boats which the city has.

Climatic conditions on the coast of California render certain times of the year most advantageous for work with dredge and net. In most parts the morning is the best time for surface collecting. A

[1] Camelo Bay is believed to be one of the most advantageous places for the study of marine zoölogy between Point Conception and San Francisco.

stiff breeze ordinarily arises in the afternoon and renders the collection of surface life almost impossible. Surface collecting by night, so profitably carried on at Newport, met with considerable success on the coast of California. The fogs which in some months hang for many hours above the water is detrimental to this kind of work.

Calms, while of great advantage to the student of surface collections, try the patience of the naturalist engaged in dredging who has no steam launch at his control. The best time to dredge [1] with a sailing craft was found to be about noontime, as there is less liability to be becalmed at that time, and it is too early for the heavy winds of the afternoon.

In my trip across the Santa Barbara Channel, the Müller's net was used at intervals to get some idea of the general facies of the surface life from this region of the Pacific. The contents of the net was made up of representatives of all the more important surface animals from the Narragansett Bay. These animals are of course represented by different genera and species from those found in New England waters, but the general character of the surface life is much the same. As compared with the same latitudes on the Atlantic, it did not seem as rich.[2]

The phosphorescence which is a direct index of the amount of surface life in the sea is often very brilliant on the Pacific coast. I have studied this light at various points on the Mediterranean, along the Florida Keys, on the coast of New England and at the Bermudas but have never seen it more striking than in the surface waters of the Santa Barbara Channel and in the fiords of the island of Santa Cruz. In a canon fiord under Punta del Diablo, at about 9 o'clock in the evening, I witnessed a phosphorescent display of this kind of most extraordinary character. Aside from its natural beauty it was indicative of an abundant harvest with the Müller's net. The signs did not fail, although the light, as so often happens in surface collecting, was mainly due to multitudes of one genus of animals. At this time it was due to large numbers of a species of Copepod which is often very abundant in the Santa Barbara Channel.

I have noticed in studies of live animals carried on at the Bermudas, at Tortugas and on the coast of New England, that in the

[1] I refer to shallow-water dredging and to dredging with the sailing crafts which a visitor to the coast is obliged to use.

[2] The author has in preparation a paper in which the new genera and species of invertebrated animals found on the coast of California in surface collecting and shallow-water dredging will be described and figured.

former localities marine animals in aquaria are very tenacious of life. I believe this is in part due to the fact that there is a more uniform temperature in the winter at Tortugas, or that the changes are not as sudden in one place as in the other. At Newport, for instance, the temperature of the water varies very greatly day by day, and pelgic animals are very sensitive to this change. Pelagic animals at Santa Barbara live longer without change of water than those on the coast of New England, and the conditions of temperature seem more like those of Bermuda than of the coast of New England.

I was much surprised at the great range of temperature which the common Actinian of California can bear without harm. Water which is almost lukewarm does not kill it. In pools left by the tide well-expanded specimens live for hours in water exposed to the rays of the sun. By the peculiar habit which they have of covering themselves with sand they are able to live out of the water in the warm air for several hours.

I can think of few more difficult tasks than to determine the best locality in New England to place a zoölogical station. Any committee which has such a task, especially if a majority of its members are those who have never done any marine zoölogical work at any place, has my hearty sympathy. There may be places better adapted for this or that kind of work, better suited for the sise of the endowment or more convenient of access, but it is a hard task to declare which is the best place for a station. One is tempted to say that there is no place which is bad if the naturalist means to *do* work rather than discourse on *how* to do it.

On the Pacific coast the problem is the same as on the Atlantic. One cannot say that this or that point is the best place to work until he or others have tried all. Honest work at almost any place on the Pacific as on the Atlantic marine zoölogy will bear good fruit.

The time has come when a permanent, well-endowed zoölogical station is needed for the study of marine animals of the coast of California. An abundant harvest in all branches of zoölogical study awaits those whose good fortune it may be to originate and carry on such a station.

While it is not intended in this article to belittle the contribution to our knowledge of the animals of the coast which have already been made, it is believed that the work already begun is but a small part of what will result if a permanent station, directed by those

who have been drilled in methods of study in marine laboratories in Europe and America, is established.[1]

The author has been told that a movement is now on foot to found a marine zoölogical station in California. It is hoped that the information is correct. It is believed that if such a laboratory is properly conducted it will lead to most important results in the advancement of science.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

THE satire which has been everywhere for a half century leveled at the classical names of towns in New York State, given by some schoolmaster who was in a position to give them, should have taught American nomenclators of later date a lesson. Perhaps the reference to the classical dictionary has been less frequent since that time, but the poverty of imagination of the modern American has been none the less apparent. It is pardonable in immigrants to name a locality in America after their birthplace in some European country; but when the "stock American" must search European and classical geographies for names, he advertises two things: first, his want of esthetic capacity; second, if perchance he select some euphonious name from the Greek, his want of national spirit and character—in form at least. What can be more incongruous than the naming of one of the canyons of Colorado the Canyon of Lodore! But what especially moves us to make these remarks is the fact that we are threatened, according to the daily press, with a still more objectionable piece of Jenkinsism. The plain adjacent to the Salt River of Arizona, where so many important archæological

[1] It would be a most interesting part of my article, if space permitted, to record the many valuable papers which have already been published on Californian Marine Invertebrated Animals. These are mostly in systematic zoölogy. The Molluca are well known, something is known of the Crustacea, Echinoderms, Actinians, and Medusæ. The sponges, Bryozoa, Tumicata, Worms, Nudibranchs and one or two other groups await even systematic identification and description. The study of larval forms of animals, of embryology, of anatomy and histology is almost unknown as far as California marine invertebrates are concerned.

remains have been recently discovered by the Hemenway Expedition, is to be called The Plain of Tempe! Can no names be selected from the noble vocabulary of the Pueblos, or from the Spanish-American historian of three centuries ago, that we must once more throw away our character in this way. Let us see. The name of the Great Colorado River, into which the Salt River ultimately finds its way, was the Tison—a dignified name, capable of almost any application. The region of the Moquis was Tesayan. The region of the Puerco River of the East was Tiguex—a word of entirely classical form. The Rio Grande was the Cicuyé. Towns of the region were Acuco, Tutahuaco, Chia (modern Cia), (north of which was the Province of Quirix), and Braba, at the head of the Jemez River. All of these are available names, of euphonious and even classical form, appropriate to the country, and not copied from any other region. We commend them respectfully to the gentlemen in charge of the Hemenway Expedition.

Cannot something be done to change the north, south, east and west places that we have in such numbers, and to prevent the creation of any new ones? Why shall we disfigure our map with a North Dakota, for instance? Call it Mandania, or some other original name. The Canadians have preëmpted Assiniboia—so we cannot use that. Let us have Tacoma for Washington Territory, as has been long proposed. When Montana is divided, name one of its parts Absaroka, after the Crow Indians—the best specimens of the aboriginal American on the continent.

We recall two instances of changes of name in the East, with which we emphasize our remarks. New Jersey once had a flourishing town of Longacoming. The name was one of the few instances of successful composition of English words to be found in America. It was changed by some person of perverted sensibilities to Berlin, and is now so called! In eastern North Carolina is a pretty village once called by the euphonious Indian name of Nahunta. When we last visited the place it was called Frémont, spelled with an "é." Comment is unnecessary.

RECENT LITERATURE.

GRAY'S "ELEMENTS OF BOTANY."[1]—This is a thorough revision of the deservedly well-known *Lessons* in which, for almost a generation, American botanists have made their first acquaintance with elementary botany. In the revision the venerable author reverted to the title of his first book, which appeared fifty-one years ago! Naturally, this coincidence of names suggests a comparison of the two books.

The first *Elements* was a duodecimo of four hundred and twenty-six pages, and was brought out by the house of G. & C. Carvill & Co., of New York, in 1836, the preface bearing date of April of that year. There is a good deal of similarity between this pioneer and the book which now, after the lapse of half a century, bears its name; and still there are very many differences.

In the early book the word protoplasm did not occur, for the very good reason that Mohl had not yet coined it; nor is there any direct reference to the thing, while in the present work protoplasm, cells, cell-contents and cell-walls, receive sufficient attention to give the beginner a general knowledge of what they are.

Vegetable physiology was very crudely treated in the earlier book, the extensibility, elasticity, hygroscopicity, endosmosis and excitability of plant tissues being gravely discussed in a way in striking contrast with the admirable summary given in Section XVI. of the later work.

In the first *Elements* "spongioles" were still supposed to be the organs of absorption in roots, and there was supposed to be a distinct ascending and descending sap in the stem. The turpentine of the Conifers and the latex of various plants were considered to be special kinds of descending sap. The movements of plants were discussed as among the curious things, but the meaning or purpose of the movements was not suspected. In describing *Dionœa muscipula*, it was said of the unfortunate insect that its "only chance of escape consists of remaining perfectly quiet until the leaf uncloses"! Pollination was, of course, treated in the old way: the Barbary stamens were said to "seldom fail to project a quantity of pollen upon the stigma," and it was stated that "the relative position of the anthers and stigmas is generally such as to favor mechanically the application of the pollen to the latter."

Turning to the new book, one sees what a great advance has been made in this field—which we may call Darwinian botany—in which such terms as close fertilization, cross-fertilization, cleis-

[1] *The Elements of Botany, for Beginners and for Scholars.* By Asa Gray. Ivison, Blakeman & Co., New York and Chicago. 1887. 8vo., 226 pp.

togamy, anemophilous and entomophilous flowers, dichogamy, heterogamy, etc., etc., occur. Not less striking is the contrast between the new and the old in the chapters which treat of the flowerless plants. Half a century ago the spores of the Equisetaceæ were still doubtfully discussed: the sporangia of ferns were supposed to be transformed leaves, and the search for their stamens and pistils had scarcely been given up. In these and the mosses—in fact, throughout the whole of the Cryptogams—there was no hint, as yet, of sexual organs. Compare these crude paragraphs with the concise and lucid exposition given in the new *Elements*, where the same groups of Cryptogams are discussed--but how differently! Pteridophytes and Bryophytes are given modern characters and a modern treatment. Thallphytes are briefly treated under Algæ, Lichens and Fungi, although with the statement that "of late it has been made most probable that a lichen consists of an alga and a fungus conjoined;" and, further, that "botanists are in the way of bringing out new classifications of the Thallophytes, as they come to understand their structure and relations better."

When the earlier book was written Linnæus had been dead but sixty years, and his system had still so strong a hold that eighteen pages were given to an exposition of it and a discussion of the question of supplanting it with something better; and the Natural System stood so much in need of argument that forty-four pages were given to it. In the new book a short paragraph is all that remains of the discussion of the Linnæan System, and less than two pages suffice for the Natural System.

It need only be said that not only do these contrasts show us what advances have been made in botany in half a century, but a comparison of these two books shows, still more, the remarkable growth and perennial youth of the master-mind who wrote them. It is not given to many men to live to see such great changes in the aspect of a science as has been the good fortune of Dr. Gray, and still fewer have had the strength or ability to adapt themselves to the new views and theories.

The new book has so much to commend in it that we are loath to lay it down. We particularly like these sentences in the preface: "No effort should be made to commit technical terms to memory. Any term used in describing a plant or explaining its structure can be looked up when it is wanted, and that should suffice." And this one, on page 156: "Even the beginner in botany should have some idea of what Cryptogamous plants are, and what are the obvious distinctions of the principal families." We like the adoption of the spelling, Phanerogam, and the names Pteridophyta and Bryophyta, and the abandonment of the "superfluous" terms *frond* and *stipe* and replacing them with *leaf* and *petiole*, in describing the structure of ferns.—*Charles E. Bessey.*

KARPINSKI'S "UBERSICHT DER PHYSIKE-GEOGRAPHISCHEN VERHÄLTNISSE DES EUROPÄISCHEN RUSSLANDS."[1]—This brochure, with its series of small maps, is a valuable addition to our knowledge of Russian geology. At the outset the author states the curious fact, that even the oldest sedimentary rocks of Russia have not been altered, clay and sand being recognizable even in Cambrian strata, and a layer beneath the sediments of the coal formation being in some places recognizable physically and chemically as turf. Crystalline gneiss comes to the surface in Finland, Olonetz and Archangel, also in Volhynia, Podolia, Cherson, etc., in the south of Russia. Crystalline rocks are met with at a depth of 100 Russian fathoms below St. Petersburg, and at 300 to 500 fathoms below Moscow.

The oldest sedimentary strata (Cambrian) are the plastic clays of the St. Petersburg and Esthonian governments. Upper Silurian sediments occur in localities distant from each other, in the governments just named, in the south of Poland, and in three points on the eastern limits of European Russia. There can be little doubt that the Cambro-Silurian sea extended across the centre of Russia, from the Baltic to the Ural. In Upper Silurian times this sea had become much smaller, and was for the most part limited to the west near the Baltic, with an outline in Podolia and northern Bessarabia. Upper Silurian beds also reappear in the north. Thus at the commencement of the Devonian probably almost all European Russia was dry land, though sea spread from the Urals far over Asia. The fauna of this eastern Lower Silurian sea strikingly resembles that of the basin of the same age in Western Europe, though separated from it by 200,000 square versts of Middle and Upper Devonian strata. This later Devonian sea extended from the Arctic Ocean to the Caspian region. Only about 150 species of invertebrates are as yet known from the Devonian of Russia, whilst almost three times this number occur in Belgium. During the Carboniferous period the greater part of Russia was covered by the ocean, though the coast had advanced eastward since the Upper Devonian. This Carboniferous sea spread westwards over Asia to the Irtish and Altai.

In Permian times parts of Cawland and Poland were covered by the sea; but, though the eastern coast of European Russia was pushed forward considerably, an unbroken sea still covered eastern Russia from the Arctic to the Caspian. The Siberian sea probably became dry land before the beginning of the Permian. The main Permian sea probably communicated with that in the region of the Aracco by a strait on the site of the Caspian. In Triassic times this sea still farther dwindled, until finally it became a network of

[1] Ubersicht der Physike-geographischen Verhältnisse Europäischen Russland wahrend der verflossen an geologischen Perioden. Von A. Karpinski, a. d. "Beitragen s. Kennt. d. Russ. Reiches. u. d. angrenzenden Lander Asicris." St. Petersburg. 1887.

separate basins. This change, commenced in the Permian, ended by converting into dry land all European Russia except the south-west part of Poland. During the Middle Trias, Upper Trias, and Lower Jurassic, the land surface of Russia was much as now, except that marine beds occur in southern Poland, and Liassic beds in the Crimea and Caucasus. In Upper Jurassic times the sea again spread over a large part of Russia, probably commencing in the west, as is evidenced by typical Middle Jurassic strata in that quarter. The similarity of the fossil forms of this wide-spread sea, which stretched from the Arctic to the Caspian, and covered most of the Caucasus, to those of Western Europe indicates free communication. At the end of the Jurassic period the area of this sea became much narrowed by the advance eastward of its eastern coast line, yet still communicated with the Jurassic waters of Western Europe until the Upper Volga stage. During the Lower Cretaceous only a narrow belt of sea divided the land of Europe from that of Asia towards the north, and this belt disappeared in the Upper Cretaceans, at which period, however, the loss was more than compensated for by the submersion of almost the whole of Southern Russia. During the older Tertiary the northern boundary of this sea advanced southwards. In Miocene times the regions around the Caspian and Black Seas formed part of the Mediterranean and Sarmatian basins, the latter extending eastward to or beyond the present Aral Sea. Lastly, in Post-Pliocene times, the Aralo-Caspian basin covered a large area northward of the Caspian, while the ice of the Glacial Period swept downward from the north over by far the greater part of European Russia, almost reaching the Aralo-Caspian basin. W. N. L.

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GENERAL NOTES.

GEOLOGY AND PALÆONTOLOGY.

ON THE THEORY OF GLACIAL MOTION.[1]—As glaciers deport themselves like rivers, in that they are constantly flowing, with greater velocity at centre than at margins, above than below, form pools and rapids, and conform themselves to channels, Prof. Forbes was led to propose the theory that: "A glacier is an imperfect fluid or viscous body which is urged down slopes of a certain inclination by mutual pressure of its parts."[2] He explained the veined structure of glaciers as being due to differential movement of its parts.

Against this view, it was urged that ice is a brittle solid, which in the laboratory cannot be moulded as a semi-fluid, or even in nature, when in passing over a change of declivity of even 4½ degrees, it becomes ruptured. Consequently, Prof. Tyndall applied Faraday's "Law of Regelation,"[3] that ice when broken and moistened, re-united and could be moulded into any form by repeated crushing and pressure, and proposed the "Fracture and Regelation theory." He explained the veined structure of glaciers as being analogous to the slaty cleavage of certain rocks—the result of transverse pressure.

Canon Moseley[4] calculated that the resistance of ice to descent is thirty-four times gravitation, and, therefore, fracture and gravitation could not be maintained. He likened the motion to the creeping of a leaden roof, owing to the expansion and contraction from change of temperature, which expansion Dr. Croll[5] modified in assuming the transmission of heat from molecule to molecule with successive liquefaction and solidification of the glacial waters.

Malleability, plasticity and viscosity are different degrees of the same property. Prof. Heim[6] distinguishes between these last two semi-fluid forms. In plastic bodies, the internal cohesion is less than internal resistance, and, therefore, under pressure these will flow, but under tension they are not drawn out, but are brittle. In viscous bodies, the internal cohesion is greater than internal resistance, and, therefore, they will not only flow under pressure, but in tension they are drawn out before rupture. He concludes that glaciers are plastic bodies, and explains the veined structure as being due to partial liquefaction under compression in passing through narrow

[1] Read before the Royal Society of Canada May, 1887, and before the A. A. A. S., Aug., 1887. Printed from advance sheets of Trans. Roy. Soc., Canada, for 1887.
[2] Travels in the Alps, 1843.
[3] Forms of Water.
[4] Proc. Royal Society, 1869.
[5] Climate and Time.
[6] Handbuch der Gletscherkunde von Dr. Albert Heim, Stuttgart, 1885.

channels, as it had been discovered that ice can be melted by pressure (Thomson). He attributes the motion to plastic flow under gravity, rupture, partial regelation, and a sliding motion (which is slight).

From observations in the Alps, and especially in Norway, my conclusions are that the motion, in the main, is the result of gravity on a semi-fluid body, wherein there is viscosity as well as plasticity, as defined by Prof. Heim; the motion, of course, being greatly modified by heat. My conclusions are based upon:—(1) The flow of the glacier, not merely in conformity to the channel, but about loose stones, which cause the lower surfaces of the glacier to be grooved (see fig. 1, in my Glacier Erosion in Norway[1]) without any lateral ridges being produced from the ice that filled what are now its channels, such being moulded into the mass (this is *plasticity*). (2) A tongue of ice (see fig. 3) pushing against a boulder, was bent back without rupture on either side of the hanging plate,—the ice on one side being in tension and on the other in compression (here is viscosity). (3) A large rounded boulder (see fig. 2), held in the side of a moving glacier, where the rounded ice wall rose about thirty feet above the stone, which was being rolled along as the ice moulded around it, had just been crushed by weight. The glacier rose along its winding course to the snow fields, 1,500 to 2,000 feet above the stone. Consequently the crushing weight upon the granitoid boulder must have been derived from the vertical component of the momentum of descent of the whole mass, which could be transmitted thus only through a semi-fluid body. (4) The flow of the upper layers of ice over the lower was seen when the glacier was impeded by a barrier (see fig. 4).

The experiments of Herr Plaff[2] show that a solid body can be pressed into ice at a temperature about freezing point as rapidly as glaciers ordinarily move; whilst at a temperature a little above, the motion is greatly accelerated, but if below 0° C, the plasticity of the ice diminishes rapidly to almost zero. However, as shown by the sub-glacial streams in winter, the temperature of the inferior surface glacier is not below freezing point.

The effects of increased summer sunlight, as well as direct heat, as shown by the experiments of Rev. A. Irving,[3] in which he transmitted both sunlight and heat waves through ice, is to accelerate the movement as the former is converted into heat undulations, and radiated against the lower part of the glacier from the adjacent rocks, thus increasing the fluidity of the ice and flow of the glacier, owing to increase of temperature.

The temperature of the lower surface of the glacier is also slightly increased by the radiation of the internal heat of the earth, yet

[1] See American Naturalist, March, 1888.
[2] Nature, Aug. 19th, 1875.
[3] Q. J. G. S., Feb., 1883.

this is very slight, as the amount radiated per annum is only enough to melt 6.5 millimetres of ice.[1]

Although glaciers do not conform to all the inequalities of their beds, and at the ice-falls and elsewhere became fractured, and subsequently re-united, whether by heat regulation or plastic flow, the fluidity theory is the most acceptable explanation of the motion of glaciers, even when the angle of descent is reduced to almost zero, and modern observations only supplement the reasons upon which Prof. Forbes proposed his theory more than forty years ago.—*Prof. J. W. Spencer.*

A Cretaceous Bird-Track.—Professor F. H. Snow has recently, in the *Trans. Kansas Acad. Sciences*, described a fossil bird-track discovered in the Dakota sandstone, in Ellsworth county, Kansas. The impression appears to have been made by the left foot of some bird with an elevated hind-toe just reaching the ground. The ball of the foot is deeply impressed and the posterior toe has made an unmistakable imprint, proving the avian character of the footprint. It measures two inches from anterior middle claw to claw of posterior toe. This discovery considerably lowers the geological horizon of Kansas birds, since nearly all the material for Marsh's *Toothed Birds* was obtained from the Niobrara, the highest group of the Cretaceous represented in Kansas. Below this lies the Benton, followed by the Dakota, resting unconformably on the Permo-Carboniferous rocks.

Professor Snow continues thus: "The wonderful luxuriance of the land vegetation of the Dakota, and its marvellous similarity to the Dicotyledonous forest-growths of the warm-temperate climes of the present day, have rendered these sandstone beds a most fascinating field of investigation for both Paleo-botanists and Neo-botanists. The finely-developed and perfectly-preserved foliage of oaks, willows, poplars, laurels, sarsaparillas, magnolias, sassafras and other kindred forms belonging to genera now long since extinct have hitherto suggested a beauty of landscape whose perfection was only marred by the apparent scarcity of animal forms. . . . . Our bird-track supplies the missing element of graceful ærial forms. From the size of the footprint, it may be safely inferred that the bird which left it was somewhat larger than a pigeon. It was probably a bird with teeth," "with habits similar to those of the modern tern."

The Affinities of Miolania.—G. A. Boulenger reports (P Z. Soc. Lond., June 23, 1887) that the large Plistocene Chelonian Miolania, which was regarded by Huxley as probably belonging to the group Cryptodira, and closely allied to Chelydra, Macroclemmys and Platysternum, is, in fact, like all the recent tortoises of

[1] Elie de Beaumont, Thompson Woodward and others, give range from five to eight millimetres. University of Missouri, May 1st, 1887.

Australia, a member of the Pleurodira. Mr. Boulenger bases his opinion upon the examination of a nearly perfect skull with the two cervical vertebræ attached. The structure of the alveolar surface of the skull indicates an herbivorous animal; the ungual phalanges and the curious sheathed tail a terrestrial one. This sheathed tail, with its opisthocœlous centra, is unique among the Pleurodira, and points to a distinct family. The ilium shows a surface for attachment to a sacral.

The Pleurodiran characters are—the broad pterygoids, with outer palatal borders forming wing-like expansions; the tympanic cavity completely surrounded by the bony roof; the articulation of the mandible by a condyle fitting into an articular concavity of the quadrate, and the form of the cervical vertebræ.

Geology of the Solomon Islands.—Mr. H. B. Guppy has recently published a work upon the Solomon Islands, divided equally between the volcanic and calcareous members of the group. The volcanic islands fall into two classes—the first comparatively modern and mainly composed of little-altered augite sandstones, andesitic pitchstones, tuffe and agglomerates; the second, composed partly of the above rocks, but in part of much more ancient crystalline masses, consisting chiefly of altered dolerites, quartz-diorites and porphyies and serpentines.

The coral rocks of the Solomon Islands are divided by Mr. Guppy into: (1) True coral limestones; (2) Coral limestones which have the composition of the coral muds or sands now forming near coral reefs; (3) Rocks having the composition of volcanic mud and pteropod ooze; (4) Foraminiferal limestones; (5) Rock resembling a consolidated deep-sea clay (red clay). The two last classes were evidently deposited at depths of not much less than two thousand fathoms in an ocean far from continental land; and this is the first proof of their existence above sea-level.

Mr. Guppy draws the following inferences: (1) That these upraised reef-masses, whether atoll, barrier reef or fringing reef, were formed in a region of elevation; (2) That such upraised reefs are of moderate thickness, their vertical measurement not exceeding the usual limit of the reef-coral zone; (3) That these upraised reef-masses, in the majority of islands, rest on a partially consolidated deposit which possesses the characters of the "volcanic muds" that were found, during the Challenger Expedition, to be at present forming around volcanic islands; (4) That this deposit envelopes anciently-submerged volcanic peats. The author says: "I never found one (raised reef) that exhibited a greater thickness of coral limestone than one hundred and fifty feet, or, at the outside, two hundred feet."

Geological Survey of Arkansas.—From a small pamphlet —Annual Report of the State Geologist of Arkansas for 1887—

we learn the Survey began work June 24th, with a corps of a director, three paid and seven volunteer assistants. The work done the first year has been the triangulation of the immediate vicinity of Little Rock; the examination of localities reported to yield gold and silver, especially in Garland and Montgomery counties; a reconnoissance in the central part of the State; tracing the limits of the Cretaceous in the southwestern part of the State. The bill providing for the survey makes appropriations for its continuance for two years.

GEOLOGICAL NEWS.—PALÆOZOIC.—Dr. J. V. Deichmüller describes two new species of the genus Etoblattina Scudder obtained at Grügelborg, near St. Wendel (Rhenish Prussia), not far from a spot where fish, insect and plant remains have been previously found. They are described under the titles of *E. ornatissima* and *E. rollei*.

CRETACEOUS.—Mr. A. S. Woodward concludes, after examination of the five series of examples in the British Museum, that *Cyclobatis oligodactylus*, the so-called "Torpedo," from the Cretaceous of Mount Lebanon (Syria), is really a member of the sting-ray family (Trygonidæ). Among his reasons are: The pectoral fins are uninterruptedly continued to the end of the snout, and were thus, probably, confluent in front—a condition never met with among the Torpedinidæ; the pelvic arch is placed far forward; there are no traces of median fins, and the skin is armed with spinous tubercles.

FROM an examination of specimens in the Cambridge and Brighton Museums (Eng.), Mr. A. S. Woodward concludes that the puzzling genus Ptychodus, which was by Agassiz and Owen referred to the Cestraciontidæ, is doubtless a true ray, though possibly belonging to an extinct family.

MR. J. W. DAVIS (*Trans. Roy. Dublin Soc.*, 1887) describes the fossil fishes of the chalk of Mount Lebanon. In this important paper no less than ten genera and sixty-six species are introduced to scientific knowledge. Among these are two genera and twelve species of Selachians, of which group nine genera and sixteen species occur; two new species of the Pycnodont genus Palæobalistum, and two forms having some affinity with Amia; several new Berycidæ; two species of Platax; a small flying-fish; a Fistularid, and several Salmonidæ and Clupeidæ; also, *Xenophilis carinatus*, six species of Rhinellus and two species of Anguilla, the first Mesozoic eels yet known,—are among the Teleosteans.

GEOGRAPHY AND TRAVEL.[1]

AFRICA.—THE EASTERN DESERT OF EGYPT.—"Notes on a Sketch Map of Two Routes in the Eastern Desert of Egypt" is an interesting account of the scenery, etc., of a little-known part of Egypt proper, viz., the stony desert lying between the Nile valley and the Red Sea. The desert rises from the Nile for about a hundred miles, where the elevation is 2,000 feet, and thence shelves more sharply to the Red Sea. The Red Sea slopes are blessed with frequent rainstorms; waterfalls, crystal pools, fern-clad grottoes, even trees, can be found in the wadis or valleys which seam their sides, and even the Nile slope has its picturesque ravines and tree-sprinkled nullahs. The inhabitants of the district are the Ma'aze tribe of Bedawin, who live in goats'-hair tents, to the north; and the more civilized Ababdi to the south. This Eastern Egyptian desert was probably the scene of the first monasteries in the world. Those of St. Anthony and St. Paul, about nine miles apart, and situated about seventeen miles from the coast, in latitude 29°, are still visited by travelers.

Almost the entire traffic between Rome and India passed, two thousand years ago, along the old trade route between Kosseir, on the Red Sea, and Koptos (modern Kuft), on the Nile. Every five or six miles along the route a more or less ruined khan exists. In the Messägh El Bagar are quarries, once worked by the ancient Egyptians, and bearing inscriptions by the Persian conquerors. Roman stations exist, one of them is Saghi or Naka'al Teir. Ibex are abundant, choosing for their home the wildest and most inaccessible mountains.

THE RAIAN MOERIS.—Mr. Cope Whitehouse sees in the Raian basin the Lake Mœris of ancient geographers, and states that surveys carried out under his direction by the authorization of the Egyptian government, prove that the area can again be converted into a storage reservoir for the surplus waters of the Nile. The number of reclaimable acres in Lower Egypt is given at about five millions; and the surface of the Wadi Raian, at 20 metres above the Mediterranean, at 346,000,000 metres, with 25,540,000 metres of contents. Colonel Ardah states that there are no engineering difficulties in the way of utilising this large basin.

PHYSICAL GEOGRAPHY OF FERNANDO PO.—Petermann's Mitteilungen contains an account of the physical geography of Fernando Po, by Oscar Baumann, a member of Dr. Lenz's expedition. The island

[1] Edited by W. N. Lockington, Philadelphia, Pa.

is one of a volcanic group which may be regarded as the result of an eruptive fissure extending southwest from the Cameroons mountains to the island of Anno Bom, or even further, and seeming to find in the Rumbi mountains a continuation in the heart of Africa. The volcanic peak O-Wassa or Clarence Peak, 10,030 feet in height, almost entirely covers the northern half of the island. West and northwest this mountain is cut by deeply eroded gorges ending in a narrow belt of flat country; to the north and northeast the sides slope gently to a precipitous rocky coast; on the east the precipitous slopes end in a grassy plateau about 1,300 feet above the ocean, while on the southwest there is a gradual descent to the plateau of Batec, which connects O-Wassa with the southern mountain system. The crater is 575 feet deep. The southern mountains for the most part present an almost perpendicular front to the sea. They form two chains and are basaltic. A volcanic mass south of these ranges has what appear to be remains of craters. The principal river is the Uaya or Shark. Few of the rivers rise at a height of more than 2,000 feet.

Asia, etc.—The Transcaspian Oases.—The mountainous part of Transcaspia, according to M. A. Konschin, is bounded west, north and east by an interminable sand and salt desert, which is rapidly advancing over the mountains and gaining upon the zone of alluvial soil formed by the erosion of the mountains. A tract of country of this recent "loess," extends from Kizil-Arvat to Sarakhs, and equals in area the Khiva oasis, though from lack of running water it forms a dreary contrast to it.

The Caucasus.—Though Elbruz is still the monarch of the Caucausus, several peaks are now known to exceed 16,000 feet. Among these are Tetnuld (16,700 feet), recently ascended by Mr. Douglas Freshfield; a peak climbed in 1886 by Mr. Dent and Mr. Donkin (16,550 feet by their estimation); Schkara and Djanga, which Mr. Freshfield estimates respectively at 17,200 and 16,900 feet, and the Koshtantau, 17,096, and Dychtau, 16,925 feet, of the Russian maps. Mr. Freshfield states that travel in this region of grand mountain scenery is now quite safe.

Ascent of the Owen Stanley Range.—Messrs. C. H. Hartmann and G. Hunter have succeeded in reaching the summit of the Owen Stanley, the principal range of mountains in British New Guinea. Twenty-seven friendly natives accompanied them in the ascent. Some difficulty, which was peaceably overcome, was encountered with a tribe which guards the great mountain Paramagoro, believed to be the abode of the spirits of the departed. It rained nearly all the time the party were on the mountains. The flora was magnificent in the extreme. It does not appear that the highest summits were reached.

Discoveries in New Guinea.—Two new rivers, named by their discoverers the Jubilee and the Douglas, have been found and mapped by the exploring party sent out on the *Victory* by Messrs. Burns, Philp & Co. Very few natives were met with, except upon the sea-coast, and these were not particularly hostile. The Douglas was followed to Bowden junction, from whence the eastern tributary (Philp River) was taken until a point was reached about 100 miles up the stream and 25 from the German boundary. The Aird River was found to be but one of the mouths of the Douglas. The Jubilee River opens into Deception Bay, at the head of the Gulf of Papua, about half a degree west of the mouth of the Douglas, and trends northwestward toward the Albert Victor Range. It, also, was followed for about 100 miles. The entire coast region here is very swampy, with dense undergrowth, but the interior is a hilly wooded country. Cretaceous limestone was met with on the Philp River, while basaltic rocks occurred still higher up, and were also met with upon the Jubilee. Both rivers have several mouths, their deltas covering about 40 miles respectively. The natives gave indications of Dravidian origin. Their canoes were dug-outs with outriggers, and often large. They wore nose-pencils, and distended the lobes of the ears.

Geographical News.—Dr. A. Meyer, of Leipzig, who has recently succeeded in ascending Kilimanjaro to the glacier-walled crater-summit of Kibo, and has explored the volcanic plateau which lies between Kibo and Kimawenzi, estimates the altitude of the former at 19,680 feet, instead of 18,800, as believed by Johnston, who reached 16,000 feet.

M. Sibiriakoff has again despatched the steamer Nordenskiold to the Yenisei *via* the Kara Sea. The vessel left Norway in August, and reached the mouth of the Petchora, where she received a cargo of skins, corn, tallow, and mammoth tusks. The Phœnix of Leith succeeded in entering the Yenisei itself.

From accounts received from various parts of the Arctic Seas of the state of the weather and the ice during the past summer it appears that the steady and continuous prevalence of easterly and northeasterly winds forced the ice from the regions north of Spitzbergen and Nova Zembla down into the seas around Northern Norway, Jan Mayen, Iceland, the Faroë Islands, and the east coast of Greenland. This is thought to account for the early setting in of winter experienced in England.

Dr. H. V. Jhering has voyaged up the Cainacuam, a river in the Brazilian province of Rio Grande do Sul, from its delta to the town of S. Jose. Throughout its lower course the river winds in sharp curves, and while the right bank is steep and wooded, the left is flat and covered with gravel. Higher up both banks

are wooded, and slope gently. Dr. Jhering's map (Petermann's Mitteilungen) shows that the Cainacuam has five mouths, while that of the government engineer (1882) shows but three. Many valuable woods occur in the forests. The "campos," or open tracts, which are invariably higher than the forest-covered country, are referred by Dr. Jhering to the diluvial period, while the wooded lands are alluvial.

M. von Fetvelde, in a "Notice" upon the Congo Free State, gives its area at 1,075,000 square miles.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—The volcanic bombs from the Lake Laach district are divided by Hubbard[2] into four classes—old crystalline and schistose bombs, sanidinite bombs, trachyte bombs, and basalt bombs. The last three varieties are difficult to separate from each other, but are easily distinguishable from the first class. After discussing very briefly the various theories proposed to account for these bodies, the author proceeds to investigate those in which *nosean* occurs. He examines two hundred and sixty thin sections of nosean-bearing bombs, and reaches the following conclusions: (1.) The Nosean is in greater part a druse mineral. (2.) The inclussion so characteristic of this mineral consist of magnetite, either fresh or slightly altered. (3.) The little red octahedra so frequently accompanying the titanite of the Lake Laach bombs is closely related to the pyrrhite of San Miguel, and has probably been derived by the alteration of titanite. Several other points of interest in relation to the minerals occurring in these bombs are noted. The most important results reached, however, are those which have been mentioned. —The elæolite-syenite from the vicinity of Rio de Janeiro, Brazil, has recently been carefully examined by Fr. Graeff.[3] The mass of the rock is described as possessing a holocrystalline hypidiomorphic structure. Its principal constituents are hornblende, orthoclase, elæolite, augite, and mica. The feldspar is noticeable for the possession of a parting[4] parallel to 7 $P\bar{\infty}$. In other cases it is intergrown with very fine lamellæ of plagioclase, thus showing striations when examined under the microscope in polarized light. The elæolite is generally fresh, but in some instances is altered into sodalite and analcite. The accessory minerals are titanite, apatite, zircon, fluorite and a black garnet. The rock is interesting, as affording another example of the predominance of hornblende

[1] Edited by Dr. W. S. Bayley, Madison, Wisconsin.
[2] Min. u. Petrog. Mitth., viii., 1887, p. 356.
[3] Neues Jahrb. f. Min., etc., 1887, ii. p. 222.
[4] cf. W. Cross, Monog. xii. U. S. Geol. Survey, p. 348. Mr. Cross finds a parting in the sanidine of the Leadville rhyolites, which is parallel to $\frac{1}{2}P\bar{\infty}$.

over augite in elæolite-syenites. In it are many little veins of a finer-grained elæolite-syenite, which show very clearly the effects of pressure, and which are remarkable for the number of accessory minerals they contain. A second variety of the rock, found as blocks in the Rio de Ouro, consists of elæolite, orthoclase, ægirine and mica, together with a large number of accessory constituents. Among the latter are *rinkite* and *lavenite*. The former[1] occurs in long narrow plates, marked by cleavage lines parallel to their longer axes. The mineral is slightly pleochroic in yellow tints. The plane of its optical axes is perpendicular to the cleavage. It is readily attacked by concentrated hydrochloric acid, with the separation of gelatinous silica. The lavenite[2] occurs in highly refractive, strongly pleochroic, honey-yellow crystals, and is closely associated with the magnesium-iron constituents. A third variety of the Elæolite-syenite is porphyritically developed. It occurs in the form of a dyke in the holocrystalline rock described above, and contains inclusions of a finer-grained rock of the same general nature.—The massive rocks of the Leadville Region, according to Mr. W. Cross,[3] comprise quartz porphyries, rhyolites, andesites, porphyrites and diorites. The porphyries are the most interesting, in consequence of their relation to the ore bodies. They are divided by Mr. Cross into several varieties, each of which is carefully described. That phase known as the Lincoln porphyry is noteworthy, as containing the rare accessory *allanite*.[4] The sanidines of some of the rhyolites possess a peculiar satiny lustre, due to fine partings parallel to $\frac{1}{2}\bar{5}\ P_{\bar{\infty}}$. The cavities of these rocks are covered with little crystals of sanidine, quartz, biotite and topaz. In the porphyrites biotite is frequently found in tiny green flakes, with a very strong pleochroism, and rounded grains of quartz are sometimes surrounded by an aureole of quartz and feldspar. It is interesting to note that in certain cases epidote is the final product of alteration of all the minerals of the porphyrites, while in other cases this final product is muscovite.—J. F. Williams[5] has recently described, in a very finely illustrated paper, the trachytes composing Monte Amiata, in Tuscany. These trachytes by alteration yield products which approach very closely to rhyolite on the one hand, and on the other appear very like andesites. The paper is enriched by numerous analyses of feldspar, hypersthene, and types of trachyte.—In a late number of the *Neues Jahrbuch fur Mineralogie*, Reusch[6] illustrates, in a very beautiful manner, the effects of pressure on sedimentary and massive rocks. In the case of conglomerates, he shows how a schistose structure may be induced which is entirely distinct from the bedding due to sedimentation.

[1] Cf. American Naturalist, 1884, p. 1141.
[2] Ib., 1887, p. 850.
[3] Monog. U. S. Geol. Survey, xii., Washington. p. 319.
[4] Cf. American Naturalist, 1885, p. 1098.
[5] Neues Jahrb. f. Min., etc., Beil. Bd. v., 1887, p. 381.
[6] Ib., v., 1887, p. 52.

METEORITES.—J. Bosscha[1] describes a meteorite which fell at Karang-Modo, on the island Java, on the 3d of October, 1883. Its thin sections show well-crystallized chondra in addition to enstatite, olivine, troilite, iron and glass. After describing the structure of the meteorite in detail the author proceeds to discuss the various theories which have been proposed to account for the origin of these bodies. He shows the weakness of each, and immediately suggests a new one, in which meteorites are regarded as made up of little particles of cosmic substances, which together with the sun, planets, etc., compose the solar system. He shows how this substance might unite and give rise to a meteorite with the brecciated structure so frequently noticed, and concludes by giving several reasons for the acceptance of his theory.—A meteoric stone which fell at Angro des Reis, in Brazil, during 1867, contains a calcium-rich red augite as one of its constituents. It is consequently richer in calcium than any meteorite heretofore described. It belongs about midway between Rose's eukrites and howardites. Ludwig and Tschermak[2] propose to establish a new class of meteorites, of which this shall be the first member. They call it the augrite class.—A lithosiderite,[3] found last March in a field eight and a half miles west of Rockwood, Cumberland county, Tenn., consists of about 16 per cent. of metallic iron and 84 per cent. of a stony portion made up of anorthite and enstatite. The metallic grains are evenly distributed throughout the mass, and when polished and etched show the usual figures. The stony part presents a brecciated appearance. Through it are scattered the metallic nodules mentioned above, and others consisting of an iron-rich enstatite. It is unfortunate that the careful analyses of the constituent portions of this meteorite are unaccompanied by descriptions of its thin sections.—A meteoric stone having the composition given below is mentioned by Daubrée[4] as having fallen at Djati-Pengilon, in Java, on the 19th of March, 1884. Its specific gravity is 3.747. Weight, 166 kilograms. Composition:—

Fe (Ni=10.78)	Troilite.	Olivine.	Bronzite.	Chromite.
21.3	5.1	33.4	39.0	0.1

It is the fourth meteorite known to have fallen in the neighborhood at various times.—Daubrée and Meunier[5] have examined pieces of meteoric stones, picked up after a meteoric shower which occurred near Grazac and Montpelegry, in Tarn, in August 10th, 1885. They regard them as new types of carbonaceous meteorites. On account of the scarcity of material a complete chemical examination was not attempted. A few tests, however, showed the presence

[1] Neues Jahrb. f. Min., etc., Beil. Bd. v., 1887, p. 126.
[2] Min. u. Petrog. Mitth., viii., 1887, p. 341.
[3] Amer. Jour. Sci., Nov., 1887, p. 387. J. E. Whitfield.
[4] Comptes Rendus, civ., 1887, p.
[5] Ib., p. 1771 and 1813.

of sulphides, chlorides, olivine, a magnetic ingredient and carbonaceous matter.—Quite a large number of short papers recording the results of the analyses of meteoric irons have recently appeared in the journals. Mr. G. F. Kunz[1] has described the tenth meteoric iron actually seen to fall. Its fall took place on March 27th, 1886, at Cabin Creek, Johnson county, Ark.—The same author reports[2] the analysis by Mr. Whitfield of a meteor from Scottsville, Allen county, Ky.—A mass of meteoric iron[3] ploughed up three years ago in a field in St. Croix county, Wisconsin, shows cubically arranged Widmanstättian figures, very much like those characterizing Meunier's jewellite group.—The Taney county, Missouri, meteorite and the meteoric irons from Chattooga county, Georgia, from Eastern Tennessee, from Waldron Ridge, and from Claiborne county, Tennessee, are briefly described by Mr. G. F. Kunz.[4]—A pallasite found at Campo de Pucará, in the State of Catamarca, of the Argentine Republic, is very similar[5] in aspect and mineralogical composition to the pallasite of Imilac, Atacama.

New Books.—The fourth and fifth parts of Professor von Gümbel's "Grundzüge der Geologie"[6] have just been received. They complete the first volume of the author's "Geology of Bavaria." In the two parts before us historical geology is completed. In addition to this there is an interesting chapter on the history of the development of the earth as a portion of the universe and as a member of the solar system. The high character of the illustrations, noticed in former reviews, is maintained, and the number of references is still further increased. The entire volume, exclusive of index, contains 1087 pages, 504 illustrations, and references to 414 topics.—Another very welcome addition to geological literature has appeared in the concluding part of the second volume of Roth's "Chemische Geologie."[7] This brochure embraces in its treatment the crystalline schists and the sedimentary rocks. Like the earlier portions of the same volume, this part is especially valuable for the copious references to articles relating to the spread and character of these important classes of rocks—classes which have hitherto been neglected by writers of handbooks of petrography. The lists of localities in which the different members of these great classes of rocks are found, is very full, except in the case of North America, where it seems that many localities have been overlooked. The book, however, is one which no geologist can well afford to be without.

[1] Amer. Jour. Sci., June, 1887, p. 494.
[2] Amer. Jour. Sci., June, 1887, p. 500.
[3] D. Fisher: ib., Nov., 1887, p. 381.
[4] Ib., Dec., 1887, p. 467.
[5] E. Cohen: Neues Jahrb. f. Min., etc., 1857, ii., p.45.
[6] Geologie von Bayern., Bd. I. Lief iv. v. Grundzüge der Geologie. Dr. K. W. von Gümbel. Kassel, 1887. Cf. American Naturalist, 1886, p. 1047.
[7] J. Roth: Allgemeine und Chemische Geologie, Bd. II. Abt. 3. Berlin, 1887. Cf. American Naturalist, 1885, p. 1215.

MISCELLANEOUS.—Kroustschoff[1] has obtained little crystals of biotite by heating to a high temperature a mixture composed of basalt glass (fused basalt and acid rocks), biotite fragments, amorphous silica, potassium silico-fluoride and sodium and aluminium fluoride.—By fusing tin stone with sodium carbonate and sulphur at a low temperature, for five or six hours, Genth[2] finds that little pyrite crystals are formed.—Alabandine is a regularly crystallizing manganese sulphide. It has been produced artificially by Baubigny,[3] by heating in a sealed tube to 100° the pink precipitate produced when hydrogen sulphide is passed through an acetic acid solution of manganese.—"Precious Stones in the United States" is the title of a very readable article, by G. F. Kunz,[4] in the December number of *Harper's New Monthly Magazine*. It is illustrated by a full-page lithographic plate of the most important gems found within the border of the United States.

BOTANY.[5]

SCHRŒTER'S ARRANGEMENT OF THE USTILAGINEÆ. — In Cohn's Kryptogamen-Flora von Schlesien, Schrœter divides the order Ustilaginœ into three families, as follows, viz. :—

I. *Ustilaginacei*, containing the genera Ustilago Pers., Sphacelotheca De Bary, Schizonella Schrœter, Tolyposporium Woronin.

II. *Tilletiacei*, with the genera Tilletia Tul., Urocystis Rabenh., Entyloma De Bary, Melanotænium De Bary, Tubercinia Fr., Doassansia Cornu.

III. *Thecaphorei*, with the genera Schrœteria Winter, Thecaphora Fingerh., Sorosporium Rudol. The genera Graphiola Poit., Entorrhiza C. Web., Piapalopsis J. Kuhn, and Tuberculina Sacc. are added in an appendix as doubtful Ustilagineæ.

SCHRŒTER'S ARRANGEMENT OF THE UREDINEÆ.—Schrœter divides the fruit-forms of the Uredineæ (in Cohn's Krytogamen-Flora v. Schlesien) into two classes, viz. : (1) Fore-fruits or first-fruits (*Vorfrüchte*)—including (a) Spermogonia, (b) Æcidia, (c) Uredo—and (2) Last-fruits or after-fruits (*Endfrüchte*), including the teleutospores. The order Uredineæ he divides into five groups, as follows, viz. :—

I. *Puccinici*, including the genera Uromyces Lk., and Puccinia Pers.

[1] Min. u. Petrog. Mitth., ix., 1887, p. 55.
[2] Contributions from the Chemical Laboratory of the University of Pennsylvania, 1887, p. 5.
[3] Comptes Rendus, civ., May, 1887, p. 1372.
[4] December, 1887, p. 97.
[5] Edited by Prof Chas. E. Bessey, Lincoln, Neb.

II. *Phragmidiei*, including Trachyspora Fkl., Triphragmidium Lk., and Phragmidium Lk.

III. *Endophyllei*, including the single genus Endophyllum Lev.

IV. *Gymnosporangiei*, with the genus Gymnosporangium Hedw.

V. *Melampsorei*, including Melampsora Cast., Melampsorella Schröt., Calyptospora J. Kuhn, Coleosporium Lev., Chrysomyxa Unger., and Cronartium Fr.

Tumble-weeds Again.—The latest addition to the lengthening list of tumble-weeds is *Corispermum hyssopifolium* L., which in northern Nebraska assumes the globular form now so well known as characteristic of the tumble-weeds, and late in the season gives itself to the winds. Fine specimens were brought to me in September, 1887, by a correspondent from Long Pine, near the Niobrara River.

In this connection, it may be well to direct attention to the account given by R. M. Christy, in his "Notes on the Botany of Manitoba," which appeared in the October number of the *Journal of Botany*, of the tumbling habit of *Psoralea esculenta*, the "Indian Turnip" of the prairies: "After flowering, instead of withering away, the plant remains standing, and by the time its seeds are ripe it has become—flowers, stalks and all—perfectly dry, brown and rigid. In this condition it is very light. The stem then separates just below the ground, leaving the entire plant free, to be blown about by the wind over the surface of the prairie, dropping its hard, oval seeds as it goes." Mr. Christy weighed a number of plants and found that, while they averaged six and a half inches in height and bore three flower-clusters each, they had an average weight of but a trifle over thirty grains.—*Charles E. Bessey.*

Botanical Work in Minnesota.—The Report on the Botanical work in Minnesota for the year 1886, which was distributed the 1st of October, 1887, gives one a very good idea of the kind of work which is being done by those constituting the working force of the Geological and Natural History Survey of the State. Professors Arthur and Bailey, with Mr. E. W. D. Holway, made an expedition to Vermilion Lake, where they remained for some time engaged in the critical study of the flora of the region. Other points were visited, and collections were made. The party was composed of experienced collectors, and the results were unusually good. Two of the party were acute students of the fungi and other lower plants, while the third was equally well prepared for special work on Glumaceæ and Amentaceæ, as well as the Phanerogams in general.

The list of specimens collected is a remarkably good one, numbering seven hundred and sixty-two in all. These are distributed as follows:—

Phanerogams	368	Oöphytes	11
Pteridophytes	26	Zygophytes	45
Bryophytes	42	Protophytes	28
Carpophytes	242		

The 227 Dicotyledons are represented by 90 Choripetalæ, 100 Gamopetalæ, and 37 Apetalæ. Of the 135 Monocotyledons, 47 are sedges, and 30 grasses. Of the Carpophytes, there are 77 Hymenomycetes, 39 Uredineæ, 36 Lichens, 57 Pyrenomycetes, and 21 Helvellaceæ. The Zygophytes are mostly Desmids (31 species) and Diatoms (12 species), while 19 of the Protophytes are Slime Moulds.

The specimens upon which the entries are made are all preserved in the Herbarium of the Survey, a precaution well worthy of general imitation.—*Charles E. Bessey.*

Botanical News.—Dr. Farlow describes in the September *Botanical Gazette* an Æcidium on Red Cedar, to which he gives the name of *Æcidium bermudianum.*——Coulter and Rose continue their useful studies of the Umbelliferæ in the October and November numbers of the same journal.——Dr. T. F. Allen appears again in the pages of the *Torrey Bulletin* for October with a paper on Characeæ, accompanied by five plates. Two new Nitellæ and one Tolypella are described.——The November and December numbers of the *Journal of Mycology* are principally filled with Dr. J. W. Eckfeldt and M. W. Calkins' Lichen Flora of Florida, being a catalogue of species, with notes, and also notices of new species.——Part 3 of Professor Greene's *Pittonia* contains an excellent biographical notice of the late Dr. Albert Kellogg, well known for many years as a collector and student of the Pacific coast plants. The editor, in an article on Echinocystis § Megarrhiza, insists strenuously that the older name of *Mara* should be used instead of Megarrhiza.——The Californian Manzanitas received the attention of Dr. C. C. Parry in a paper read before the California Academy of Sciences. They belong to the Uva-Ursi section of the genus *Arctostaphylos*, and number twelve species in all.——R. P. Bigelow's paper on the Structure of the Frond in *Champia parvula*, read before the American Academy of Arts and Sciences, now issued as a reprint from the "Proceedings," is a careful study of the structure of this member of the Florideæ.——The Development of the Ostrich Fern (Onoclea struthiopteris), by D. H. Campbell, being the "Walker Prize Essay" for 1886, has been printed in the Memoirs of the Boston Society of Natural History. It is accompanied by four good plates.——The Bulletin of the Illinois State Laboratory of Natural History, lately issued, contains an important contribution to our knowledge of the Erysipheæ, by Professor Burrill and F. S. Earle. The Illinois species are carefully described, and the synonymy has received close attention. Several

changes have been made in the names of common species.——J. G. Baker continues his synopsis of Tillandsieæ in the November *Journal of Botany*, reaching No. 112, with the article to be continued. In the December number of the same journal Otto Nordstedt points out that a great many of the figures in Cooke's British Dermids are copied from Ralfs, Archer, Brébisson, De Bary and many other authors, in spite of the statement that "the greater part of the figures have been drawn direct from the specimens themselves." We must suppose that the artist imposed upon the author in this case.——G. Massee publishes in the December *Grevillea* a revision of Polysaccum, admitting eight species, of which two, *P. pisocarpium* and *P. turgidum* are American.

ENTOMOLOGY.[1]

THE HOP PLANT-LOUSE, *Phorodon humuli*.—An important contribution to our knowledge of the life of this species was made during the year just closed, by the Entomologist of the U. S. Department of Agriculture. Professor Riley, assisted by Mr. Pergande, Mr. Howard, and others, very carefully traced the transformations of the species throughout one complete cycle, *i.e.*, from the winter eggs of one year to those of the year following.

The most interesting result of these investigations is the confirmation in a striking manner of the previously known fact that this species passes the winter on plum trees.

It is urged by Professor Riley that this is the only mode of hibernation of the species, or at least that it does not winter on the hop. This is a point of the highest practical importance, and one which must be settled before a complete plan of defence from the ravages of this pest can be matured. Unfortunately, the evidence adduced by Miss Ormerod in her report for 1884, and indicating that one form of this species winters on the roots of hops, is too strong to be set aside by anything yet advanced.

The following is a résumé of the transformations of this insect, as determined by Professor Riley, and published in advance of his annual report[2]:—

"As soon as plum leaves put out in spring, the first generation of lice hatch from the winter eggs on plum. These are wingless agamic females, giving birth to young like themselves without the intervention of males. The third successive generation upon plum, however, is winged, not wingless, and the first fledged individuals

[1] This department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] L. O. Howard, The Cultivator and Country Gentleman, November 17, 1887.

of this generation the present season were observed June 4. The individuals of this winged generation migrated at once to the hops, settled and began giving birth to the fourth generation, which consisted, as did the second, of wingless, agamic females. The fifth, sixth, seventh, eighth, ninth, tenth and eleventh generations followed, and were all composed, as was the first, of wingless agamic females, bringing observations in point of time down to the last week in August, or close to the commencement of hop-picking.

"The last week in August the offspring of the eleventh generation (themselves the twelfth) showed rudimentary wings, and at the same time the offspring born the previous week from the still living females of previous generations (as far back as the fifth) also showed plainly that they would become winged. August 26th the first winged females were observed at Cooperstown, and August 31st at Richfield Springs, the main locality for observations. September 2d they had already flown in small numbers to both Damson and wild plum, and had begun to deposit larvæ, which may be called the normal thirteenth generation. From day to day the winged lice increased in numbers until on the 13th of September the air was literally full of them, flying from the hop fields and settling on every variety of plum, and upon every available plum leaf. They were found a mile distant from any hop plant, searching for some plum tree on which to settle and bring forth young. Standing in front of a plum tree and facing toward a neighboring hop yard, Mr. Pergande observed a swarm coming from the hops and settling upon the plum. A most interesting point in this connection is the fact that none of these winged generations will settle and reproduce on hop. This was proven by careful and repeated experiment. So great were the number and so completely were the plums in certain places covered, that many of these winged females were obliged to settle upon neighboring weeds, where they brought forth young, which, however, died after feeding a few days.

"All of these winged individuals of the twelfth generation which migrated to plum up to September 28th were agamic females. (A few were still flying late in October.) Their young (thirteenth generation), however, attained full growth by this date, and proved to be all true sexual females, wingless. At this time the males were discovered. They proved to belong to the twelfth generation, but only to the very late and much retarded offspring of the retarded agamic wingless eleventh. They developed late in September upon the fragments of hop vines still remaining in the hop fields, and became winged the last week in September, just in time to fly to the plum and mate with the wingless sexual females which became full grown at this time or a little before. Immediately after this mating the eggs began to be deposited, and by October 7th large numbers could be found without trouble on the smaller twigs and branches of plum, in and around the angles formed by the buds and twigs. Each female laid from one to three eggs."

On the Occurrence of Apterous Males among the Aphididæ.—In view of the very few species of American Aphides in which apterous males have as yet been found, it may be of interest to call attention to the occurrence of this form in certain species whose autumn life history I have lately been studying. In *Schizoneura carnicola* this is the only male form produced, and it may be found abundantly during October on the leaves and twigs of various species of *Cornus*, often *in copulo* with the oviparous females. It also occurs in the root form of the corn-plant louse (*Aphis maidis*), having been taken with the oviparous females during October, in ant colonies, about corn roots; and in a species of *Aphis*, found abundantly in certain plants of *Amarantus albus*, during October. In all of these species the male is of the same general form, being slender and flattened, with long legs and antennæ, and very active in its movements.

The only reference to the occurrence of this form in America which has come to my notice is by Professor O. W. Oestlund, in his List of the Aphididæ of Minnesota,[1] in which he records finding it in several species of *Siphonophora*. I presume that when our species are more thoroughly studied it will be found to occur quite frequently. It is to be hoped that the recent progress made in our knowledge of the life-history of the group will stimulate a more thorough study of these much-neglected insects.—*Clarence M. Weed, Ill. St. Laboratory of Nat. History, Champaign.*

The Imported Cabbage Butterfly.—Mr. S. H. Scudder has collected a large amount of data regarding the introduction and spread of Pieris rapæ in North America. This he has very carefully digested and published as one of the Memoirs of the Boston Society of Natural History.[2] This memoir is accompanied by a map showing the centres and annual areas of distribution of the species in North America from its introduction in the East in 1860 to 1886.

The chief points brought out by Mr. Scudder's paper are the following:—

(1.) The insect was first captured in this country in 1860, by Mr. Wm. Couper, near Quebec. "From what we know of the rapidity with which a single pair may propagate, without hindrance from parasites, we may conclude with almost certainty that it was introduced in the early part of 1860, or, at the earliest, at the very close of 1859." This is a later date than is commonly assigned. (2.) In addition to the importation by way of Quebec, the species was introduced independently in New York in 1868, at Charleston in 1873, and at Apalachicola in 1874. These later introductions may have been by means of coasting vessels, or by rail from the North.

[1] Fourteenth Ann. Rept. St. Geol. of Minn., pp. 19–22.
[2] l. c., Vol. iv., No. iii.

(3.) The westward spread of the species was hastened by its spreading from colonies established at Indianapolis in 1874, and at Chicago in 1875. (4.) The species has reached the natural limit to its southern extension. This is shown by the fact that it can hardly maintain itself at Apalachicola and has not pushed its way into the peninsula of Florida beyond, hardly to, Jacksonville, although it has for ten years been within what would elsewhere be not more than a year's flight away.

On the Systematic Position of the Mallophaga.—Dr. Packard reviews[1] our knowledge of the structure of the Bird-lice, and compares them with the Pediculidæ and with the Psocidæ. He concludes that the Mallophaga are nearest allied to the Psocidæ, and are degraded members of the order to which the Psocidæ belong. He divides his order Platyptera into two sub-orders:—

I. Mallophaga.

II. Platyptera genuina: Superfamily 1, Plecoptera (Perlidæ); Superfamily 2, Corrodentia.

The Corrodentia as restricted by Packard above includes the Termitidæ, Embididæ, and Psocidæ.

Entomological News.—Mr. S. H. Scudder published in the Canadian Entomologist for November "Comparative Tables for the Families of Butterflies." The characters of the families are given at great length, and include every stage of life. Bulletin No. 3 of the State Entomologist of Illinois is a Contribution to a Knowledge of the Life-History of the Hessian-fly, by S. A. Forbes. A list of the entomological writings of Dr. A. S. Packard, with a systematic and general index, prepared by Mr. Samuel Henshaw, forms Bulletin No. 16 of the division of Entomology of the U. S. Department of Agriculture; 339 titles are enumerated.

ZOOLOGY.

Contribution to the Fresh-Water Rhizopods.—During the last season some investigation was made for Rhizopods to illustrate this important group of animals before my pupils in Zoology.

Gatherings, from sphagnum swamps, the ooze of springs, ponds and sheltered coves along the Penobscot River near Orono, were examined.

By consulting Dr. Leidy's Rhizopods of North America the following species were determined.

[1] American Philosophical Society, September 2, 1887.

The majority of the species enumerated occur in a sphagnum swamp on the College farm. The list represents the observations of a single season, and will, of course, be extended by closer research.

References to figures and plates refer to Dr. Leidy's Rhizopods of North America.

ORDER PROTOPLASTA.

Amœba proteus, Leidy. Page 30, Pl. 1.

Widely distributed in sphagnum swamps, the ooze of springs, ponds and sheltered coves along the Penobscot. Not plentiful in individuals, but widely distributed. Quite variable in size.

Amœba radiosa, Ehrenberg. Page 58, Pl. 4.

Observed in the water of a sphagnum swamp on the College farm. Two individuals were seen which assumed forms like Figs. 1, 3 and 6, Pl. 6. Changing slowly from the spherical form, and protruding a variable number of pseudopodia from one to several.

Amœba villosa, Wollich. Page 62, Pls. 1, 2, 7.

Several specimens of the general form of Figs. 8 and 9, Pl. 5, were seen in the water of a spring on the College farm, associated with other Rhizopods.

Difflugia globulosa, Du Jardin. Page 96, Pls. 15, 16.

Forms like Figs. 8 and 9, Pl. 16, are not uncommon in sphagnum swamps about Orono.

Difflugia pyriformis, Leidy. Page 98, Pls. 10–13, etc.

Quite common in sphagnum swamps in the Penobscot Valley. Variable in form.

Difflugia ascula. Page 116, Pls. 15, 16.

Forms in outline like Fig. 31, Pl. 16, were seen, but the triangular orifice in most had sides more nearly straight than Fig. 30. Not scarce in sphagnum swamps. This form is probably only a variety of D. lobostoma.

Hyalosphenia papilio, Leidy. Page 131, Pl. 21.

This handsome species is very common in the water of sphagnum swamps. Forms like most of the Figs. of Plate 21 were observed, and also another form, of which several specimens were seen, that is not figured by Dr. Leidy. This variety has the general outline of the normal form, but is abruptly narrowed at the minute orifices shown on the sides of Fig. 7, Pl. 21. The outline of variety lobata is given in Fig. 1, which shows the extreme of constriction. Intermediate forms seem to connect this with the normal form. The color of the test and sarcode contents of the variety is the same as in the normal form. The sarcode in all the forms observed was encysted, and composed largely of green corpuscles. The normal form is very abundant.

Hyalosphenia tincta, Leidy. Page 138, Pl. 20.

Forms like Figs. 11 and 12, Pl. 20, are not uncommon in sphagnum swamps, associated with H. papilio and H. elegans.

Hyalosphenia elegans, Leidy. Page 140, Pl. 20.

This beautiful species does not seem to be so common as H. papilio, but is quite plentiful.

Nebela collaris. Page 145, Pls. 22–24.

The specimens observed from one sphagnum swamp were in form like Fig. 17, Pl. 22, but sculptured more like Fig. 14. Other specimens like Fig. 14, with encysted sarcode, were seen.

Nebela flabellum, Leidy. Page 152, Pl. 23.

Forms like Fig. 18, Pl. 23, are not uncommon in sphagnum waters about Orono.

Heleopera pieta, Leidy. Page 162, Pl. 26.

Forms like Fig. 8, Pl. 26, are rather plentiful in sphagnum waters about Orono.

Arcella vulgaris, Ehrenberg. Page 170, Pls. 27, 28.

Clear individuals like Fig. 4, Pl. 27, were seen, also dark-colored forms flattin in shape, but probably referable to this species.

Arcell discoides, Ehrenberg. Page 173, Pl. 28.

The specimens observed were like the clear individual, Fig. 29, Pl. 28. No colored forms were seen.

Centropyxis aculeata, Ehrenberg. Page 180, Pls. 30, 31, 32.

Forms like Fig. 30, Pl. 32, with five spines, somewhat more slender and shorter, were in a gathering from a sphagnum swamp on College farm.

Campascus. New variety.

Forms like Figs. 2 and 3 in outline are not uncommon in sphagnum water. The shells are brownish and membranous, and, so far as observed, probably empty. They have the best neck of Campascus, but differ very much in the emorginoli fundus from C. cornutus. The specimens are about the same size as C. cornutus, but somewhat variable, as shown by figures. There is nothing like it figured in Leidy's Rhizopods. It is probably another form of this polymorphous species.

Englypha alveolata, Du Jardin. Page 207, Pl. 25.

The typical forms common in springs and also sphagnum water about Orono.

Englypha ciliata, Ehrenberg. Page 214, Pls. 35, 36.

Spineless forms like Fig. 23, Pl. 36, found in sphagmoss in a Tamarack swamp.

Ciliated forms like Fig. 20, with plates barely visible, and with two nuclei situated as in Fig. 4, but smaller. Sphagnum swamp, Orono, Me.

The typical forms common in springs, and also sphagnum water about Orono.

Assulina seminulum, Ehrenberg. Page 225, Pl. 37.

Forms like Figs. 15 and 24 are found sparingly in sphagnum moss in Tamarack swamps about Orono.

Trinema enchelys. Page 296, Pl. 39.

Forms like Figs. 46 and 47 are very common in sphagnum water. A form like Fig. 4, with a brown chitnoid membrane, is quite common. In form it is somewhat like Fig. 12, but there is nothing like it figured. It is probably referable to this species. Our specimens were not active, and the pseudopodia not observed.

ORDER HELIOZOA.

Actinophrys sol, Ehrenberg. Page 235, Pl. 40.

Forms like Figs. 1, 2, 3 and 4 were observed in the water of sphagnum swamps, and from pools along the Penobscot River about Orono.

Acanthrocystis chætophora. Page 264, Pl. 43.

Type forms observed, though more filled with green corpuscles than Leidy's figures. Springs swamp, near Orono.—*F. L. Harvey.*

WORMS IN HEN'S-EGGS.—Dr. Edward Linton records (*Proceedings U. S. National Mus.*, 1887) the occurrence of *Distomum ovatum* in the white of a hen's-egg from Berlin, Wisc. "The occurrence of this parasite in the eggs of fowls, while not common, is not difficult to account for. Its favorite place of lodgment in its host is in the bursa of Fabricius. An individual may occasionally penetrate one of the passages which communicate with the cloaca. It is well known that such excursions are sometimes made by this parasite into the oviduct. If it should penetrate beyond the shell-forming glands when an ovum is *in transitu*, it would not be an improbable thing if the parasite should find itself enveloped in the glairy albumen which is being exuded there."

In this connection we may refer those interested to a recent article on two cases of enclosure of nematodes in hen's-eggs which are discussed in Dr. Pelletan's *Journal de Micographie*, xi. pp. 407 *et* 512, 1887.

THE RELATIONS OF THE EUROPEAN AND AMERICAN HELICIDÆ.—Dr. Wilhelm Kobelt, at the Wiesbaden meeting of the Congress of German Naturalists, compared the recent and fossil European Helices with those of America. He showed that while to-day the molluscs of Europe differed greatly from that of Central America, the miocene forms of the former country so resembled those of the Antilles and of North America that the latter might be regarded as descended from the former. He is even inclined to believe in such a genetic connection, which, contrary to that of mammals and plants, has gone from east to west, and claims that a land-bridge between the two continents must have been north of the Sahara, because of the absence of African types in America.

EXCRETORY ORGANS OF SPIDERS.—Some recent investigations of Dr. J. C. C. Loman (*Tijdsk. Nederl. Dierkunde Vereen* i. p. 109. 1886–7) on the so-called Malpighian tubes of spiders are of interest. In sections of a Javanese trap-door spider he finds that these organs differ very materially from those of the hexapods and agree with those of the amphipods, in the fact that they are diverticula of the mid rather than of the hind gut. As to the development of these organs in the spiders almost nothing is known, the two most recent authors on arachindan embryology—Locy and Schimkewitsch—having nothing to offer on the subject. The bearing of the observations of Loman tend to show that these organs are not homologous in all the "Tracheates," and possibly that the arachnids and crustaceans are more closely related than is admitted in most text-books.

THE MYLOHYOID GROOVE IN THE MESOZOIC AND RECENT MAMMALIA.—The Mesozoic Mammalia subdivide into two series, *A*, the *Multituberculata*, a marsupial suborder characterized by tubercular teeth and a pair of very prominent incisors; and, *B*, a less clearly defined group in which the incisors are numerous and subequal in size and the molars are cuspidate. All of the latter, so far as known at present, are characterized by a groove extending along the inner face of the mandible from the orifice of the dental canal, which Owen has called the *mylohyoid* groove, from its possible homology with a similar groove in the human jaw. The Multituberculata entirely lack this groove. Much stress has therefore been laid upon it in the various systems of classification. Owen figures a similar groove in *Myrmecobius*. Dr. Otto Meyer, however, recently called my attention to the fact that the groove is not present in *Myrmecobius*, and threw a doubt upon its taxonomic value. This led to my examining the mandibles of all the marsupials and Primates in the collections of Princeton, Philadelphia Academy and Yale College, with the following results: 1°. A groove similar to the mylohyoid groove of the human jaw is frequently but not constantly present among the primates: *Gorilla savagii* (strongly developed), *Troglodytes niger*, wanting; *Simia satyrus*, faintly developed; *Cynocephalus* (species?), very distinct. 2°. Among the marsupials this groove is even more variable, never very distinct; sometimes present, sometimes absent, in different individuals of the same species: *Myrmecobius*, it is entirely wanting in the two specimens in the Yale College Museum, but this does not prove that it is always absent in this genus; *Phascolomys*, present in half the specimens examined, absent in the remainder; faintly seen in some specimens of *Dasypus* and *Didelphys; Dasyurus*, *Thylacinus* and *Bettongia*, absent in all specimens thus far examined. 3°. In all the above cases this groove extends obliquely downwards and forwards from the orifice of the dental canal. The inferior dental nerve and artery branch at this orifice, part entering the canal,

part extending along the inner surface of the ramus, as the mylohyoid nerve and artery, to supply the mylohyoid and digastric muscles. There is thus little doubt that this groove lodges this artery or nerve in all these recent forms, as it does in man. 4°. In all the mesozoic mammals in which the groove is present it invariably extends from near the orifice of the dental canal, for a greater or less distance, along the inner face of the ramus, sometimes descending rapidly to the lower border (*Phascolotherium*), sometimes reaching the symphysis (*Amblotherium*). From its constant relation to the dental canal and variable development I think there is little room for doubt that this groove lodged either the mylohyoid nerve or artery; at least there is no ground for any other supposition. 5°. *Dromotherium*, from the Triassic, the oldest of the mammals of Series *B*, presents an exception; I cannot discover the orifice of the dental canal in its usual position; the anterior border of the pterygoid fossa is not clearly defined, as in all the Jurassic genera, but gradually closes into a long, narrowing groove, which suddenly terminates in an orifice in the middle of the ramus beneath the last premolariform tooth. It appears as if the inferior dental nerve and vessel may have lodged in the groove and entered the jaw at this anterior point. From all these data I see no present ground for changing the designation of this groove in the Mesozoic mammals, as employed by Owen, but strong reasons for not attaching any great taxonomic value to its presence or absence.—*Henry F. Osborn.*

The Inter-connections of Smooth Muscular Fibres.—Dr. N. Kultschizny states (*Biol. Centralbl.*, 1887) that smooth-muscle fibres are not connected together by the oft-described intercellular cement, but by means of minute protoplasmic fibres, and that between the cells exist intercellular spaces. A similar view has been held and taught for some time by some American histologists, and these even go farther and trace in the existence of these intercellular bridges, the evidence for evolution of all meso-dermal tissues from an epithelium.

The Faunal Relations of Fernando Noronha.—At the meeting of the Linnean Society of London, November 3, 1887 (according to the *Zool. Anzeiger*), Mr. H. M. Ridley gave an account of his natural history collection in Ferdando Noronha. The group of islands in question is in the South Atlantic, one hundred and ninety-four miles east of Cape San Roque. The largest is about four miles long and two miles across at the broadest part. Although chiefly basaltic, phonolite rocks crop up here and there. The cliffs are steep, but otherwise the soil is fertile; there is an absence of sandy bays on the south side. Generally speaking, the specific animal forms differ on the opposite sides of the main island. The indigenous fauna and flora seems to have been

much modified, and in some cases extirpated by human agency. Of mammals, the cat is reported to have become feral, and rats and mice swarm; Cetacea occasionally frequent the coast. The land birds comprise a species of dove, a tyrant, and a greenlet (Virio). Sea birds are numerous, but by no means so abundant as they were formerly when the island was first discovered. Among the reptiles were found a species of Amphisbæna, a scink (*Euprepes punctatus*), a gecko; turtles are also frequently seen in the bays. Batrachians and fresh-water fish are entirely absent. One butterfly, a well-known Brazilian species, was plentiful; but insects, though abundant, were poor in number of species. Two species of Trochi called for remark as having a southern distribution, the remainder of the marine shells, and indeed most of the marine fauna and flora, show affinities to that of the West Indies.

Muscles of Birds.—The researches of the late A. H. Garrod in the line of avian myology, did much to place the classification of birds upon a firm basis, as may be seen in any recent ornithological treatise of value. He showed that the peculiarities of certain muscles could be made of value in indicating the affinities of the different genera families, etc. Garrod's work has recently been presented to the American students in the shape of an illustrated review by Dr. Shufeldt, in the *Journal of Comparative Medicine and Surgery* for October, 1887. Dr. Shufeldt does not discuss the laryngeal muscles, but he adds to the muscles employed by Garrod the dermo-tensor patagii, as well as calling attention to the systematic value of other characters than the mere presence of Garrod's classificatory muscles.

A Gular Gland in the Banded Ant-Eater.—Mr. F. E. Beddard calls attention (*Proc. Zool. Soc.* London, p. 527. 1887) to a remarkable glandular structure just in front of the sternum of the banded ant-eater (*Myrmecobius fasciatus*) of Australia. In the region of the gland the integument is naked and studded with the apertures of the glands of which there are four distinct kinds: (1) sweat glands; (2) sebaceous glands; (3) sudoriferous glands; and (4) a large compound tubular gland. Of these, 1, 2, and 3 are confined to the integument, but the fourth is situated in the connective tissue underlying the dermis. The duct of the last has not been found. Histologically it resembles a sweat gland, and is divided by partitions of connective tissue.

The Mammalia of the Maragha Bed.—A report on this subject by Dr. Kittl is published in the last number of the *Annalen of K. K. Naturhistorischen Hofmuseums*, of Vienna. The species obtained number twenty-two, of which more than half have been previously discovered at Pikermi, near Athens, and the others do not indicate any wide difference of fauna. Among the peculiar

species may be mentioned the rhinoceros, *Aceratherium blanfordi* Lydd , and *Hippotherium richthofeni* Koken. Prominent Pikermi forms are—*Machœrodus leoninus* R. & W.; *Palœoreas lindermayeri*, *Helladotherium duvernoyi* Gaudry ; *Mastodon pentelici* Wagn. ; *Palhyœna hipparionum* Gerv.; *Hyœna eximia* Wagn., and *Sus erymanthius* R. & W. Dr. Kittl deecribes the Carnivora in the present paper. He finds the following new species: *Machœrodus orientalis* K., *Meles maraghanus*, and *Meles polaki*. The Machærodus is one of the smaller forms, allied to *M. megantereon*, but was a formidable animal—as large as a full-sized leopard.

Maragha is in Persia. The horizon is Upper Miocene, or Miopliocene.

Zoological News.—General.—Observations on the structure and distribution of stripe and unstriped muscle in the animal kingdom, conducted by C. F. Marshall, go to show that the striped form is found in the disc of medusæ, but not in Actinia nor in Echinoderms. Some Vermes show moths, as the Arthropoda and the Arachnida possess the striped form; but the Leech and the earthworm are without it, and the mollusca which possess it are those which, as Pecten, move rapidly. An intracellular network is always present in striped muscle-fibre, and this network is developed where rapid and frequent movements have to be performed. The contraction of the striped muscle-fibre is referred by Mr. Marshall to the action of the longitudinal bars of the network, while he considers the transverse fibres as passively elastic, and by their rebound as causative of the relation of the muscle-fibre. The cardiac muscle cells contain a network similar to that of ordinary striped muscle.

Arthropoda.—The development of *Peripatus Novæ-Zealandiæ* is described by Miss Lilian Sheldon in the Quart. Jour. Micros. Soc., Nov., 1887. The species is viviparous; the segmentation resembles that noted by Henking in certain Phalangidæ; and the embryo derives nutriment partly from the yolk within its body, partly from a peripheral layer.

Fishes.—Professor D'Arcy W. Thompson states (Ann. and Mag. Nat. Hist., Sept., 1887) that the blood-corpucles of Myxine, instead of being small and round, like those of Petromyzon, are large and oval, like those of skates or dog-fish.

Polyprion prognathus, the Hapuku of New Zealand, and one of the most esteemed food-fishes of the Southern Hemisphere, is, according to Dr. A. Günther, identical with *Polyprion kneri*, described by Steindachner, from Juan Fernandez. It is therefore widely distributed and antipodal to the only other species known, *P. cernium*. The latter is shown by Lowe (Fish. Madiora, p. 185) to be a deep-sea fish, swimming near the surface when young, but when adult living at depths of 300 fathoms or more.

In one of the numerous ichthyological papers emanating from the Indiana University, Carl H. Eigenmann and Eliz. G. Hughes give a review of the North American species of the genera Lagodon, Archosargus and Diplodus. The first has one species, while the second and third are represented in North America by four and seven species respectively. Mr. Eigenmann also describes *Ophichthys retropinnis*, from Pensacola, Fla.

Miss Rosa Smith bases a new species of Rhinoptera upon a pair of jaws found at Todos Santos Bay, Lower California.

BATRACHIA AND REPTILIA.—G. B. Howes (P. Z. S., June 7, 1887) points out the existence, in the larynx of some Salientia, of a structure which he believes to be homologous with the epiglottis of the higher Amniota. These are in the form of two papillate folds, constituting a forward prolongation of the laryngeal mucous membrane. Posterior to these some Anura have also a pair of folds, which Mr. Howes entitles epilaryngeal. The epiglottis is entirely membranous, and has little if any connection with deglutition. It seems to be purely an accessory voice organ. The Batrachian larynx, like the Reptilian, is without a distinct thyroid cartilage. The author gives a list of the species in which the primitive epiglottis, the paired condition of which resembles the initial stage of the development of the organ in the human subject, was observed. Some species of Hyla are without the folds, while they are present in others.

The Bulletin of the Essex Institute, 1887, contains descriptions by Mr. S. W. Garman of the Iguanidæ and Scincidæ of the West Indies, at present in the Museum of Comparative Zoology at Cambridge. No less than twelve species are added to the genus Anolis, each species apparently restricted to a small circa. The scincoid genus Mabuia is also enriched with three new species.

Mr. Garman has also published a list of the Reptiles and Batrachians of Grand Cayman, an island of the Caribbean Sea, about 200 miles south of Cuba. Grand Cayman is of coral formation, rises but little above the sea, and must have received its land animals from the neighboring islands not so very long ago. An Anolis and a Liocephalus are described as new.

Mr. Garman has recently added to the snakes of the West Indies *Ungualia curta*, *Dromicus cubensis*, and *D. ornatus*, *Alsophis pulcher*, and *Trigonocephalus caribbæus*. A small turtle, Cinosternum sp., sent to Cambridge by Professor F. Poey, seems to possess distinct specific characters.

G. A. Boulenger (Ann. and Mag. Nat. Hist., July, 1887) describes several new Reptiles and Batrachians in the British Museum, including an Anniella and a Hyla coper,[1] from Texas; and an Eiemias from the Guinea Coast.

Years ago Dumeril and Bibron described an Australian snake under the name *Furina textilis*. It has been omitted from all recent lists of the reptiles of Australia, upon the supposition that it was based upon the common *Diemenia superciliosa*. Recently, Mr. Froggat has rediscovered the species in the neighborhood of Port Darwin.

MAMMALIA.—Among the few beaver colonies still existing in Europe is that at Amlid, some distance from Christiansand, Norway. Sometimes as many as a dozen animals may be seen here in the water at one time. Their huts are built close to the shore, and have two stories, one above and the other below the water level. The walls are of timber, the roof of twigs and mud. The beavers have felled all the aspen-trees in the vicinity, and have begun to attack the birches. They cut down trees upwards of eighteen inches across at the root, but do not seem to use the larger trunks. The branches are dragged to the water-side along regular "log-runs," which are cleared of interloping roots. Sentinels are posted to give the alarm in case of danger, when all the animals leave their dwellings for the water.

A new species of Spermophilus (*S. bactrianus* Scully) and *Ellobius intermedius* Scully, are among the mammals collected by Captain C. E. Yate, of the Afghan Boundary Commission.

E. P. Ramsay has recently described three new mammals (*Antechinus froggata, Perameles auratus, and Mus burtoni*) from North West Australia.

WORMS.—In the fresh-water Dendrocœlous planariansis an organ which is usually termed the uterus. Ijima regards this as a gland for forming the egg cocoon, and the latest student (Hallez) agrees with him. Hallez regards Ijima's muscular gland as a force-pump to drive the male elements into the cloaca, and that possibly to expel the ova and cocoons. Its resemblance in certain particulars to the bursa copulatrix of the Rhabdocoela is pointed out.

BIRDS.—Dr. W. A. Haswell, of Sydney, N. S. W., recently read a paper before the Linnean Society on the early stages of the emu, detailing the history of the primitive streak, mesoderm, neurenteric

[1] The *H. arenicola* Cope.

canal and notochord. As the embryology of no member of the Ratitæ or Struthionidæ has ever been studied, Dr. Haswell's work when published will have no little value.

PSYCHOLOGY.

Evolution and Idealism.—The doctrine of idealism is naturally attractive to the minds that believe in mind. To feel that mind is all in all, and is not bound to "low material things," is as agreeable to the metaphysician as it is to the seeker for immortality. Moreover, the doctrine seems to have a certain support from the scientific side. We know that our knowledge of what are vulgarly supposed to be the properties of matter, is not derived from a single sense, and we readily understand that those properties would appear to be greatly modified, were the number of our senses reduced or increased. Moreover, we know from experience of the abnormal or diseased states, both of ourselves and of other men, that the appearances of the objective world may be wonderfully modified by changes in ourselves. The hallucinations of delirium and other forms of mental disorder, are matter of every-day knowledge; and the illusions that may deceive even the healthy mind are equally well known. The question between the realist and the idealist is, what do these facts prove?

They certainly do not prove that a universe which presents in its parts, and therefore in its entirety, the two properties of extension and resistance, has no existence. They certainly do prove that our knowledge of such universe and of its parts is imperfect. It is to remedy this imperfection, and to enlarge our knowledge that many men spend much labor and time. And the knowledge thus acquired and exactly systematized, is called science. The pursuit of science postulates the existence of that which it pursues, not as states of consciousness, but as objective realities. There are reasons for the soundness of this view, which I propose briefly to enumerate.

If a given supposed object be in reality a purely mental state on the part of the subject, a rational cause for the production of that state is wanting. But letting this difficulty pass for the time, and letting it be supposed that there is some apparent undefined cause for such state existent when the subject is present to it, if the phenomenon be only a mental state, so soon as the subject mind betakes itself to some other locality, the supposed cause must cease to exist to that person or subject. To a second person or subject who may remain behind the first, the cause of the mental state does still exist On the departure of the second person, it ceases to exist for him but continues for the third person, and so on. In the presence of these facts, consistency requires one of two conclusions, on the part of the idealist; either he must deny the validity of the mental states

of other men, or he must believe in the Hegelian aphorism, "Existence and non-existence are identical." Some idealists adopt the one, and others the other of these two horns of the dilemma.

But the difficulty is immensely increased when we contemplate the mental lives of the lower animals, with their varied sense organs and media of contact with the so-called material world. We can readily imagine the limitations under which many of them exist through their structural deficiencies; but we cannot so well imagine, though we are compelled to believe in the wonderful acuteness of the perception, and the to us incomprehensible peculiarity of sensation, produced by the various special organs of sense with which many of them are furnished. Think of the tactile sensibility to slight movements of the water possessed by the blindfish of the Mammoth Cave. Think of the sense impressions of which we know nothing conveyed by the antennæ of insects. Think especially of the "other world than ours," in which many of the Mammalia live, in consequence of the high development of the olfactory sense. We can easily perceive the result of the idealistic reasoning on the part of the inferior animals, were they capable of it. To many of them mankind would not exist; to others the sun would be a fiction. Those to whom low tones are imperceptible, would deny the existence of the only vibrations that some other species is adapted to hear.

The idealistic position which denies the existence of matter, results from a process of cancellation of the objective universe bit by bit. One animal after another, and one sense after another, are proven fallible, and so the entire objective superstructure disappears. The realist, on the other hand, adds together all the phenomena derived from all the senses of all conscious beings, thus getting a positive result, where the idealist gets a negative one. Which is the more rational of the two methods? The actual result to thought is, that we learn the insufficiency of each and every sense, but not its impotency. We are instructed that our true policy is to use our senses to the best purpose, and to add to their number, so that the defect of our knowledge may be remedied, and our mental vision enlarged more and more. And this is the mission of science.

But all knowledge, we are told, is relative, and that of the absolute reality we can learn nothing. This doctrine does not necessarily involve idealism, but it is necessarily held by consistent idealists. One can believe in a material universe and still hold that we do not know it absolutely or even truly. And as "we are all poor creatures," many of us are prone to repeat "great is the doctrine" of the Relativity of Knowledge! And the scientist echoes, but in a different spirit, great is the doctrine of the Relativity of Knowledge; yea, great is our Ignorance! Great is *our* ignorance indeed, but not "great is Ignorance!" The scientist does not worship ignorance; he worships knowledge, and his occupation is to increase knowledge. To the responsive intellect and enterprising spirit, the knowledge of our ignorance is the stimulus to unceasing labor. To men of a more

lymphatic temperament the knowledge of ignorance seems to paralyze their lives. But science has done much towards elucidating the order of the universe, and will do more.

Evolution gives the *coup de grace* to idealism of the consistent type. In the gradual unfolding of organic life it sees the two universal facts, subject and object. It sees them interact and influence each other. Under the influence of active, conscious life thousands of tons of substances are transported from place to place and metamorphosed in the process. Under the influence of life, from which consciousness may or may not be absent, thousands of tons of matter have been made into soil, rocks, and living tissue. On the other hand, the objective environment has constrained all living things into rigid modes, and has extinguished millions. In the midst of all this turmoil, consciousness has picked and wound its way, ever gaining in strength and skill, till now we behold man. Of all animals, man controls his environment most completely. He begins by making his own heat and light; he makes his food to grow, and his skin is partly his own manufacture. He does this, and very much more, with infinite pains and toil, and yet some individuals of his species actually deny the existence of this environment, which has compelled him to be what he is!

It is equally competent for the materialist to deny the existence of mind, as for the idealist to deny the existence of matter. The materialist, beholding the imperfection of the senses, may pronounce them to be, one by one, incompetent witnesses, and declare them to be illusions. The mind, which is the product of these impressions, immediate or remembered, falls with them; it is also an illusion. But the fact is, both exist, object and subject, matter and mind. And since matter cannot study mind, mind must study matter, and by so doing grow to more absolute knowledge and greater control of its physical basis, and therefore of itself.

It can now be seen why the study of the "problem of cognition" has little interest to progressive science. Its result is an expression of our ignorance in philosophical form, a proposition which the scientist is not disposed to deny. But when he asks the philosopher "what do you propose to do about it?" and gets the same old story reiterated from the old scholastics to the latest relativist, he turns from such blind guides to his own, and to nature's laboratories, and goes to work. And the theologian applauds the philosopher, and says of the scientist in his prayers, "I thank Thee that I am not as this section-cutter, this bug-hunter, nor even as this bone sharp." But the scientist knows that he holds the key of the situation, and he lets the philosopher and the theologian rejoice themselves, each in his appropriate department of Swedenborg's heaven. The field of Idealism has been well worked out, and we of this age should thank the mighty men of the past for having done it for us. We can now go on with an easier mind in a more profitable pursuit.

Doctor Montgomery's last article in Number 21 of *The Open Court*, states at once the strength and weakness of idealism. Its principal weakness is that it is unable to stand alone without a good strong realistic prop somewhere behind. Thus the Doctor says (p. 587): "The tri-dimensional, hard, colored, sounding, scented, heated matter—fancied by Professor Cope and others to subsist outside consciousness, and believed by them to be directed and organized by such consciousness—is, indeed, through and through, a fictitious entity, consisting of nothing but a set of our own percepts illusively projected into non-mental existence." This looks like pure idealism, but he lets in a "non-mental existence." Now what is this? On page 589 (bottom) he says: "Now the realistic assumption which the philosophy of organization here makes, is indeed, the simplest possible, and is in full agreement with given facts. It supposes that there subsist in nature non-mental existents possessing the power of specifically affecting our individual sensibility, and of manifesting their special characteristics by means of the different conscious states they arouse in us." This is a little more definite, and the Doctor even calls it by its right name, a "realistic assumption." This is quite to my liking, but I cannot perceive how such "non-mental existent" can have less than three dimensions and still exist. And in order to prove to me that mind or consciousness has no control over this tri-dimensional "non-mental existent," Dr. Montgomery must go into further particulars. He must prove to me than an animal does not eat or drink because it feels hungry or thirsty; does not seek shelter on account of weather or temperature; expresses nothing in its voice of pain, desire or pleasure; that the horse does not run because he is whipped, or the bird build because it feels the necessity of laying, etc., etc.

I must here protest against the misinterpretation of an expression contained in one of my earlier articles, which was not sufficiently guarded, it is true, to preclude such misconstruction. It is possible to say correctly that "mind is a property of matter, as color and odor are properties of the rose," without meaning to say that the two properties are such *in the same manner*, as is inferred by my critic (p. 589). My article in Number 19 of *The Open Court* is sufficiently clear as to what I understand by mind as a property of matter, so that it is unnecessary to go into a fuller explanation. Suffice it to say that the conscious and the unconscious properties of matter cannot be confounded by any rational thinker, and that such confusion is entirely foreign to my thoughts. More than one-third of Dr. Montgomery's article Number 5 is thus irrelevant. In the other two-thirds I fail, as yet, to find a definite theory which shall explain the apparent facts of designed movements of animals, differently from that which is held both by physiological science and by popular belief. That is, that the design in them is the direct result of a limited control which conscious states have, or did once have, over the energy and the matter concerned in producing them. —*E. D. Cope*, in No. 23 of *The Open Court*.

NOTES ON FORSTER'S TERN,[1] *Sterna forsteri* Nutt.—In spending my summer vacation two years ago at Piney Point, Maryland, some ninety miles from Washington, I had abundant opportunity to study the movements of this beautiful bird.

Their elegant appearance, whether flying gracefully over the water in search of their food, or floating jauntily on a drift log, or darting swifty from place to place, makes them very attractive.

I started out one fine morning, on a collecting tramp, and the sun, which had risen clear and bright, gave evidence of a warm, sultry day; but the wind, shifting, scattered the clouds over the sky, and a dull, rather cool day followed. I continued my walk to the river; the receding tide had leit a sand bar high and dry some twenty feet from the shore, and on this I noticed a flock of Forster's terns, which took flight as I approached. I fired, one dropping dead amid the shrill cries of his companions. As the water was very shallow I commenced to take off my shoes and stockings in order to wade out and secure my specimen; but, to my astonishment, the whole flock renewed their cries vociferously and commenced to circle around me, and from me to the dead bird, as if they knew that I was responsible for their companion's misfortune.

As I commenced wading, the birds seemed to ascertain my object, and they, with one accord, began to fly higher and enlarge their circle, and, flying faster than the rest of the flock, the first six or eight separated themselves in single file, and each one while flying, with a strenuous effort, gave the dead bird a push with its feet; each individual of the flock pushed in rapid succession, and soon would have had the specimen beyond my reach if a friendly boat had not come along and rescued it and dispersed the flock.

For a whole flock of birds to act in perfect unison and with one impulse, to remove a bird in the quickest and most effective manner, is certainly a wonderful performance, which can hardly be credited to instinct (as it is scarcely to be supposed that the affection for members of a flock would be as strong for a mate as for their young).—*P. L. Jouy in Field and Forest.* Washington. Vol. II., No. 2. August, 1876, p. 29.

VARIATIONS OF THE NORMAL KNEE-JERK.—The first and most extensive paper in the first issue of the *American Journal of Psychology* is by Dr. W. P. Lombard, and describes the results of more than six thousand experiments made upon himself by the writer. It was found that not only does the extent of the knee-jerk or knee-kick vary according to the force of a blow struck just below the patella, but also in response to stimuli of other kinds. All the

blows were struck by a hammer which struck with a known force, appended to an accurate recording apparatus. The extent of the jerk proved to be an index of the state of the nerves. The first series of experiments showed that the jerk obtained upon rising in the morning was small; that that given after breakfast was, on the average, higher than those at subsequent hours, and that it rose after each meal; also, that the effect of muscular exercise was always to largely diminish its extent. Slight mental fatigue does not seem to affect the knee-jerk, while unusual mental fatigue produced an irritability which reinforced it. Irritation of the skin, voluntary movements, attention to unusual sounds, exciting mental work (such as the recitation of a stirring poem), music (especially of an emotional character), exciting dreams, all increased the extent of the knee-jerk. Violent respiratory movements also increased it, while a rise of temperature or a fall of the barometer diminished it, opposite meteorological conditions producing opposite results. A second series of experiments confirmed the results obtained by the first.

ARCHÆOLOGY AND ANTHROPOLOGY.

THE MAGIC MIRROR OF CHINA AND JAPAN.—The magic mirror is the common toilet mirror or *kagami* in everyday use in Japan. It is a thin disk of cast bronze about eight inches in diameter, or of various sizes, and has a short handle cast with the piece. The plane side is amalgamated; on the back are representations in relief of bamboos, ships, storks, trees, etc., and generally two large characters.

The performance of this mirror has long excited great curiosity and interest, and there have been many ingenious conjectures as to the reason of the strange way of its reflection. The magic is that, when it is properly prepared and the sun's rays caught upon it and reflected on a screen, the outlines of the characters and figures on the back show in the reflection. The figures appear lighter than the rest of the field, and not frequently with a sharp outline. Better results will be obtained if the mirror is slightly warmed, laid on its back on a perfectly flat surface, and briskly polished with a cloth. Then, if the sun's rays are caught upon it, at first in the reflection the figures cannot be seen, but they gradually appear and are permanent. In China its peculiarity has been long and well known, for it was spoken of with great admiration in the eleventh century by Tchin-Kouo, and the poet Kin-ma, celebrated it in verse. It is probably used as one of the very numerous agents of divination practiced there; and in passing, we note that a mirror, the symbol of purity, is found in every Shinto temple and shrine in Japan. The Chinese mirror has no handle; it is held by cords passed through lugs at the back.

They are called in China *theou-kouang-kien*, or mirrors that are penetrated by light, an expression which portrays a popular error. Ou-tsin-hing, who lived between 1260 and 1341, wrote on the subject as follows: "Here is the cause of that phenomenon which proves the employment separately of fine and coarse copper. If they have produced in the founding in a mould a dragon arranged in a circle, on the face of the mirror they engrave deeply an exactly similar dragon. Then, with copper a little denser, they fill up the deep cuts of the chisel, submit the mirror to the action of fire, after which they level and dress the face and give it a light coating of tin. When its image is reflected on the wall, it presents the clear tints and dark tints which proves that the one is of the portions of purer copper and the other of the coarser parts."[1] He claims to have seen a broken mirror which was so constructed. Aside from physical reasons, the cheapness of the *kagami* refutes the idea of this extremely difficult process to make a common toilet article.

An amusing interpretation of the riddle was brought out on questioning several Japanese. They said that magic mirrors are caused by earthquake shocks occurring just when the metal is being poured into the mould; the shock rearranges the particles and alters the reflecting powers. Workmen sometimes jar the flasks to produce the effect during the rare absence of an earth tremor in that land of seismic disturbances. Just how much magic comes from the great fish whose uneasy slumber causes earthquakes, according to Japanese folk-lore, has not been found out.

However, in the course of these inquiries a fact was elicited of some importance. All mirrors are not "magic," and they cannot be "made to order." This may have some bearing on the theory or explanation of Messrs. Ayrton and Perry, English electricians, who have accidentally observed that on amalgamation, or coating with mercury, brass expands. They think this will explain the workings of the mirror, or is a primary cause. Amalgamation would affect the thinner parts made by the pattern more than the rest of the plate, giving it the imperceptible unevenness that becomes plainly apparent in the reflected image.[2] This is the most scientific explanation that has yet been given, and may be tentatively accepted as the best yet offered. Yet it is not improbable that artificial heat, or the heat of the sun, increases the unevenness of the plate by irregular tension relative to the pattern, and is a sufficient cause. That the figures do not come out at once indicates this, and I believe it is not the least factor in the problem. It is given, at any rate, with the hope that it will throw some light on a curious and perplexing catoptric phenomenon.

Since writing this, I notice an article on this subject in the Journal of the Franklin Institute for January, 1888. The author, Mr. Ives, gives much valuable information, and thinks that the

[1] L'Univers, vol. vi.: Chine Moderne, vol. ii. p. 637.
[2] Science, July 2, 1886.

cause is to be found in the elasticity of the plate, making it slightly irregular on grinding.—*Walter Hough*, U. S. National Museum.

ANTHROPOLOGICAL NEWS.—Ensign A. P. Niblack, U. S. N., has just returned to Washington from a three years' voyage to southern Alaska, where he was engaged on Coast Survey duty, in the steamer Carlisle P. Patterson. Lieut. Niblack is an enthusiastic archæologist and has done good service to that science as the records of the Smithsonian Institution will abundantly show.

He pushes his researches among natives whenever and wherever his duties permit. He returns loaded with ethnologic material, which he will now have the opportunity to classify and describe. He has perfected himself in photography, and returns with full series of Indian villages, houses, totems, burial posts and glaciers, which, jutting into the sea and breaking off, are caught in the act of transforming themselves into icebergs. Lieut. Niblack's interest and studies have been directed to the Totem posts with which that country is so prolific. He says that winter is the only season when studies can be successfully made in the ethnology of Alaska.

The natives are then at their homes prepared to give or receive pleasure or information. In the summer they are engaged sometimes far inland on the mountains and inaccessible.

Mr. E. A. Douglas, of New York, has returned to the United States after two years' absence in Europe.

Mr. Douglas possesses one of the finest private Ethnographic collections in the United States. It was stored for safe keeping during his absence at the New York Museum, Central Park.

Mr. Douglas has now gone to Florida, where he will continue his studies until his return in May. His address is Saint Augustine.

SCIENTIFIC NEWS.

—The Middlesex Institute proposes to publish a Flora of Middlesex County (Mass.), giving a complete list of the Phanerogams and Vascular Cryptogams. In the lower Cryptogams, lists prepared by specialists will be given, as complete as the present state of knowledge permits. The work is based upon botanical researches for many years by members of the Institute, with this publication in view; supplemented by a careful examination of all works bearing upon the subject, and all public and private collections accessible. No plants have been admitted to the list except on evidence of the actual specimen or of competent botanists; and all doubtful questions with regard to identification have been referred to eminent specialists. The publication will be an octavo volume of more than 200 pages.

—The project of a Marine Biological Laboratory on the New England Coast is not languishing. Several thousand dollars have already been subscribed towards the erection of the necessary building and its equipment and maintainance. The committee on the laboratory have arranged a course of eight lectures, the proceeds of which are to be added to the fund. These lectures are as follows: Jan. 18.—Professor W. H. Niles, of Massachusetts Institute of Technology—"Mountain Sculpture." Jan. 25.—Major J. W. Powell, Director of the United States Geological Survey—"Savagery, Barbarism and Civilization." Feb. 1.—Professor H. N. Martin, of the Johns Hopkins University—"A Hen's Egg." Feb. 8.—Professor George L. Goodale, of Harvard College—"Seeds." Feb. 16.—Professor F. W. Putnam, Director of the Peabody Museum of American Archæology and Ethnology, at Cambridge—"The Serpent Mound and the Ancient People of the Ohio Valley." Feb. 22.—Professor Alpheus Hyatt, Curator of the Boston Society of Natural History—"A practical Example of the Evidence for Evolution." Feb. 29.—Doctor Henry P. Bowditch, Dean of the Harvard Medical School—(Subject to be announced.) March 7.—Professor Edward S. Morse, Director of the Peabody Academy of Science, Salem—"Reptilian Affinities of Mammals." The lectures will be illustrated by the stereopticon and the tickets for the course are placed at $5.00.

—In the spring ground will be broken for another section of the Museum of Comparative Zoology at Cambridge, Mass. It will be a continuation of the present west wing, and will be used to accommodate the growing needs of the botanical department. It will contain laboratories for the study of both cryptogamic and phænogamic botany. There will also be rooms for the exhibition of the collections already accumulated, for which there is no adequate accommodation. The fund for building has already been raised, through the exertions of Prof. J. M. Goodale. A collection of superb glass models, representing the principle species of flowering plants, is now being made in Germany, especially for this exhibit. When this addition is completed and the collections arranged, it will be surpassed by few in the world. The Museum has long outgrown its exclusively zoological character and has for many years contained the geological collections and some of the botanical laboratories have had accommodations in it for some time.

—Volume I, No. 1, of the *American Journal of Psychology*, G. Stanley Hall, Ph.D., editor, has appeared. It contains 206 pages, octavo, and numerous plates and cuts. 127 pages are devoted to original papers, and 79 pages to reviews and digests of recent psychological literature and to psychological notes. One of the most prominent objects of the journal will be to record the progress in

the study of hypnotism, especially in France. The first number contains the most extended and critical review yet published of the whole work of the English Society for Psychical Research. Single numbers, $1.00. Subscription to yearly volume of four numbers, $3.00. Remittances may be addressed to the *American Journal of Psychology*, Baltimore, Maryland, U. S. A.

—Prof. E. W. Claypole, of Buchtel College, Akron, Ohio, is the author of "The Lake Age in Ohio; or, some Episodes during the Retreat of the North American Ice-sheet;" with colored maps. McLachlan & Stewart, Edinburgh; Simpkin & Co., London.

—In compliance with what seems to be a wide-spread desire on the part of the geologists of America, a few have united in an effort to establish an American journal devoted to geology and its allied sciences. The new publication will be called *American Geologist*, and it will endeavor to promote American geology by fostering the interests of American geologists.

The subscription price is $3.00 per year, and the place of issue for the present is Minneapolis, Minn., where correspondence should be addressed to *The American Geologist*. From all geologists the editors solicit original contributions, and items of scientific news.

The editors and publishers, for the year beginning January 1, 1888, are as follows: Prof. S. Calvin, Iowa City, Iowa; Prof. E. W. Claypole, Akron, Ohio; Dr. Persifor Frazer, Philadelphia, Pa.; Prof. L. E. Hicks, Lincoln, Neb.; Mr. E. O. Ulrich, Newport, Ky.; Dr. A. Winchell, Ann Arbor, Mich.; Prof. N. H. Winchell, Minneapolis, Minn.

—The second number of Dr. Whitman's *Journal of Morphology* will contain the following articles: Dr. C. O. Whitman—"The Kinetic Phenomena of the Egg during Maturation and Fecundation (Oökinesis);" Dr. W. B. Scott—"The Embryology of Petromyzon;" Dr. Henry Orr—"A Contribution to the Embryology of the Lizard;" Dr. H. F. Osborn—"The Fœtal Membranes of the Marsupials;" George W. and Elizabeth G. Peckham—"Some Observations on the Mental Powers of Spiders." The number will be illustrated by ten lithographic plates.

—The Teachers' School of Science, which the Boston Society of Natural History is enabled to conduct by the aid of the Lowell Institute, will be continued this year. Professor Wm. M. Davis will give five lessons on the Physical Geography of the United States. The different parts of the country will be considered, not in the order of location, but in their natural order: (1) The mountains, as constituting the framework of the continent; (2) The plains and

plateaux flanking the mountains; (3) The rivers carrying the waste of the land into the ocean; (4) The lakes, temporarily interrupting the transportation of waste to the ocean and retarding the action of the rivers; (5) The shore-line where the land dips under the sea.

—Professor von Cienkowsky, the well-known student of the lower animals, died October 7th, 1887, in Leipzig. He was born October 13th, 1822, in Warsaw, and at various times held a professor's chair in Jaroslaw, St. Petersburg, and Odessa. At the time of his death he was a member of the faculty of Charcow.

—Recent Deaths.—Robert Francis Logan, an entomologist, at Spylaw, near Edinburg, July 28, 1887.——Pierre Millière, entomologist, aged seventy-four, at Cannes, May 29, 1887.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Academy of Natural Sciences of Philadelphia.—May 24, 1887.—Dr. Chapman presented "Notes on the Anatomy of *Echidna hystrix*.

May 31, 1887.—Dr. Leidy described *Asplanchna ebbesbornii*, a rotifer, originally described by Hudson from specimens obtained in Wiltshire, England. Dr. Leidy's specimens were from a duck-pond, sewage fed, below this city. The animal is viviparous and swarms in the pond in company with Daphnia. It has a single eye and a pair of lateral conical horns.

June 14, 1887.—Prof. H. F. Osborn presented a paper upon the "Structure and Classification of Mesozoic Mammalia, and C. H. Eigenmann "Notes on the Specific Names of Certain North American Fishes."

June 21, 1887.—Mr. Thos. Meehan stated that Chionanthus, though usually described as having perfect flowers, is on the borders of diœcism, having impotent anthers with a perfect pistil on one plant, and polliniferous anthers and an imperfect pistil on another. This is the rule. The male plants are the more abundant. The male flowers seem only to be visited by the pollen-eating Thrips, and are therefore anemophilous.

August 9, 1887.—A letter from Miss A. Fielde, Swatow, China, describing an aquatic larva and its case, was read. The animal is stated to be near Hydropsyche.

August 16, 1887.—Prof. J. A. Ryder presented a paper upon the "Homologies and Early History of the Limbs of Vertebrates."

American Society of Naturalists.—The annual meeting (1887) was held at New Haven, Conn., in the Lecture-Room of the

Peabody Museum, on December 27th, 28th and 29th. The following papers were read:—

Tuesday—Biology.—(1) The President's address on "The Inconstant in Biology," by Professor Harrison Allen, M. D.; (2) "Perfected Wools for Detection of Color," by Charles A. Oliver, M. D.; (3) "Injection of the Thoracic Duct," by Professor S. H. Gage; (4) Exhibition of newly-devised Physiological Apparatus, by Professor H. Newell Martin; (5) "Method of Life-size Model-making of the Larger Animals," by Mr. James H. Emerton; (6) "A Lecture-room Illustration of Variation under Domestication and in Nature," by Samuel F. Clarke; (7) "Methods of Cutting Serial Brain and Spinal Cord Sections," by Professor Henry F. Osborn; (8) "A New Automatic Microtome," by Dr. Charles S. Minot; (9) "On the Preparation of Serial Sections," by Dr. Charles S. Minot.

Wednesday—"Science-Teaching in the Schools."—Papers were read by Professor Alexander Winchell, of Ann Arbor; Professor George Macloskie, of Princeton; Professor William North Rice, of Wesleyan; Professor Ramsay Wright, of Toronto.

Thursday—Geology.—(1) "The Volcano of Kilauea," by Professor James D. Dana; (2) A Palæontological paper, by Professor William B. Scott (not read); (3) "A Simple Method of Measuring the Thickness of Inclined Strata," by Mr. C. D. Walcott; (4) "Improved Machinery and Appliances for Cutting Sections of Rocks and Fossils in Any Desired Planes," by Professor William B. Dwight; (5) "The Educational Value of Micropetrography," by Professor George H. Williams; (6) "Instruction in Mineralogy and Structural Geology in the Massachusetts Institute of Technology," by Professor W. O. Crosby; (7) "Museum-Cases in Europe," by Professor Edward S. Morse.

A resolution appropriating sixty dollars for the purchase of ten copies of Volume I. of the *American Journal of Morphology* was adopted.

Also, a resolution identical with that which passed the American Philosophical Society and six other scientific societies, requesting Congress to remove the duty on scientific books and apparatus.

The Society adjourned, to meet at the same time in 1888 at the Johns Hopkins University, in Baltimore, Md.

President, HARRISON ALLEN; Vice Presidents, G. L. GOODALE, H. S. WILLIAMS, H. F. OSBORN; Secretary, S. F. CLARKE; Treasurer, W. T. SEDGWICK; Executive Committee from Society at large, RICHARD RATHBUN and GEORGE H. WILLIAMS.

BIOLOGICAL SOCIETY OF WASHINGTON.—October 22, 1887.—Communications: L. O. Howard, An Ant-decapitating Parasite; Geo. Vasey, Notes on Western Grasses; F. A. Lucas, The Bird Rocks in 1887; A. A. Crozier, Some Botanical Terms; C. Hart Merriam, The Fauna of the Great Smoky Mountains.

November 5.—Communications: J. B. Smith, Some Geographical Variations of Insects; T. H. Bean, The young Forms of Some of our Food-fishes, with illustrations; N. P. Scudder, The Period of Gestation in the Common Mouse; H. E. Van Deman, The *Diospyros kaki* in North America; T. N. Gill, Characteristics of the Notalian Fish Faunas.

November 19.—Communications: Marshall McDonald, Explanation of Past Failures in the Culture of the Salmonidæ; Walter B. Barrows, Freshet Notes on the Rio Uruguay; T. H. Bean, Description of a new species of *Thyrsites* from the New England Fishing Banks; T. W. True, Recent Works upon Whales; F. A. Lucas, An Alcine Cemetery.

December 3, 1887.—The following communications were read: Mr. Charles Hallock, The Great Roseau Swamp; Dr. C. A. White, On the Rapid Disappearance of the Cast Antlers of the *Cervidæ;* Dr. Theobald Smith, Peptonizing Ferments Among Bacteria; Mr. C. D. Walcott, A Fossil *Lingula* Preserving the Cast of the Peduncle; Dr. Theo. Gill, The Phylogeny of the Cetacea.

December 17, 1887.—The following communications were read: Mr. C. L. Hopkins, Notes Relative to the Sense of Smell in Buzzards; Dr. Cooper Curtice, The Timber Line of Pike's Peak; Mr. Chas. D. Walcott, Exhibition of, and Remarks, on a Section of a Fossil *Endoceras,* over Eight Feet in Length; Dr. Leonhard Stejneger. On the Extinction of the Great Northern Sea Cow; Dr. C. Hart Merriam, Description of a New Mouse from the Great Plains.

Boston Society of Natural History, December 7th, 1887.—Professor N. S. Shaler read a paper on the origin of the divisions between the layers of stratified rocks. Professor G. F. Wright spoke of the glaciation of the Pacific Coast. Professor G. L. Goodale exhibited some new glass models recently obtained by Harvard University which illustrate the structure and morphology of plants.

The American Committee of the International Congress of Geologists.—This Committee met in New Haven, after the adjournment of the Society of Naturalists, on December 29th and 30th. Present—Dr. T. Sterry Hunt, Chairman; Dr. P. Frazier, Secretary, and Messrs. Cook, Cope, Dana, Hitchcock, Newberry, Powell, Stevenson, Winchell and Williams. The reports of the reporters of the different sub-committees were read and were ordered to be printed in galley form for further emendation, where thought necessary. All the reports were ordered to be completed by April 1st, 1888. A resolution inviting the Congress to meet in the United States in 1891 was adopted. The proposition to enlarge the Committee by the addition to it of additional members of the United States Geological Survey was not agreed to

INDIANA ACADEMY OF SCIENCE.—The third annual meeting of the Indiana Academy of Science was held at the Court House, Indianapolis, December 28 and 29, 1887, with Dr. John M. Coulter in the chair. The following papers were read:—"The East-West Diameter of the Silurian Island about Cincinnati," by Professor D. W. Dennis: Professor Dennis alluded to the fact that at Richmond, Indiana, there was a thin bed of rock composed of broken shells of lower diluvium age, in its character much like coquina and indicating an ancient shore line. Two similar deposits have been found in Adams and Highland counties, Ohio, and these give the means of measuring the east to west diameter of the Silurian island which existed when this rock was formed. In "Erosion in Indiana," J. T. Scovell maintained that at least seven hundred feet of erosion had taken place over the whole state of Indiana. He alluded to the ancient river channels corresponding in general to the present courses but wider and deeper, and stated that, of the drift material in the state, on the average five feet came from the state and fifty was of extra-state origin. A "Geological Section of Johnson County, Indiana," by D. A. Owen, was an account of the strata passed through in boring various wells. D. W. Dennis stated that the "Transition of *Orthis occidentalis* unto *Orthis sinuatu*" was accomplished in 300 feet at Richmond, Indiana, illustrating his point by numerous specimens. "Notes on Some Fossil Bones found in Indiana," by O. P. Hay, was the announcement of the identification of the genus Tapirus in some bones found in a sink-hole in Monroe county.

In zoology the papers were more numerous, but many of them consisted of the records of additions to the fauna of the state. Such was B. W. Evermann's "Fishes of Carroll County," in which five species new to the state were enumerated, the most noticeable being *Notropis arga* Cope, "Notes on Some Southern Indiana Fishes," by O. P. Jenkins, and "Some rare Indiana Birds," by Amos W. Butler, were of a character expressed by their titles. B. W. Evermann noticed "the Occurrence of the Star-nosed Mole in Indiana; A. W. Butler, in his "Notes on Indiana Reptiles and Amphibians," added *Plethodon cinereus*, *Hyla squirilla*, and two new species of Entænia to be described by Professor Cope to the fauna of the state. The "Additions to the List of Indiana Reptiles," by O. P. Hay, were *Cinosternum pennsylvanicum Tropidonotus rigidus*, and *Cnemidophorus sexlineatus* all on the authority of Robert Ridgway.

In 1869 Dr. Günther enumerated 193 species of fish occurring on one side or the other of the Isthmus of Panama, of which about one-third were regarded as common to both the Alantic and Pacific sides. D. S. Jordan, in his paper, "The Isthmus of Panama as a Barrier to Marine Fauna," stated that now there were known 1370 species from the same region of which but five per cent. were common to the Caribbean and the Pacific shores. With these data the recent connection of the two seas is not so probable as Dr. Günther's

fish figures would make it. In a paper on "Blind Fishes and National Selection," D. S. Jordan replied to the statement in some religious paper that "evolution would find it exceedingly difficult to account for these forms." In "The Origin of Genera," the same gentleman gave an outline of the view of Professor Cope on this subject and mentioned some of the difficulties which were presented by fishes, at the same time indicating the great aid which systematic zoology had received from the same theory.

"The Origin of Arthropods," by J. S. Kingsley, was a résumé of recent views on the origin and lines of descent of the various groups of arthropods. O. P. Hay, in his "Observations on Amphiama," gave some interesting facts regarding this batrachian. In Arkansas he found an Amphiama incubating her eggs underneath a log. She was coiled around her eggs and was very sluggish at first. Later she was quite cross and irritable, uttering a shrill sound like a whistle. The eggs, of which there are about a hundred and fifty, form long stings, the gelatinous envelope shrinking between the eggs so that the whole sting resembles a sting of beads. The young which were in an advanced stage of development were about one and three fourths inches in length with well-developed gills, each bronchia consisting of a main stalk with three feathered branches. The eggs themselves were about the size of a pea.

C. W. Hargitt had two papers: "Curiosities of egg formation," and "Notes on *Scaphiopus holbrookii*." The first detailed some cases of teratology in the eggs of hens and turkeys; the second an appearance of the spade-foot toad at Marthas Vineyard during a heavy rain during the past summer. A. W. Butler made some "Suggestions concerning a law for the Protection of Birds," stating that the present law would not stand, and that it is impossible to secure convictions under it. A committee was appointed to urge the passage of a suitable law embodying the provisions of the New York and Massachusetts statutes upon the next legislature. Maurice Thompson's "Secondary functions of the Hyoid corma in Picus and Colaptes" showed a lack of morphological and physiological knowledge.

The address of the president, John M. Coulter, was delivered Wednesday evening, and with "Evolution in the Vegetable Kingdom," tracing the origin of the sexual element in plants, and the gradual increase of the asexual over the sexual generations. Besides this there were six papers read on botanical subjects. Miss Lillie J. Martin spoke of the "Value of Organized Work in Plant Chemistry;" J. N. Rose mentioned the "Characters in Umbelliferæ," which he found of most value in the classification of this group of plants while working them up in connection with Professor Coulter for the Synoptical Flora. The most valuable characters were found in the fruit. Stanley Coulter spoke of the "Histology of the leaf of *Taxodium distidium*." He found the cell walls difficult to study on account of their thinness and the large cell

spaces. He described the strengthening cell system and the resin-ducts. The fibro vascular bundle in the centre of the leaf showed traces of its formation by the coalescence from two primitive bundles; whether these remained distinct at the tip the author could not say. There are eight stomata in each leaf, six above and two below.

John M. Coulter described the peculiar structure of the "Stornata of *Tillandia usneoides.*" The scales which give the Spanish moss its pubiscent appearance are to be regarded as leaves since each bears a stoma. Surrounding each stoma is a trichoner structure, in the centre of which are four sensitive cells. Below these comes the true stoma with its two sensitive guard cells. Experiments with the plants showed that this peculiar structure was to be explained by the epiphytic habits of Tillandia and the trichonu structure must be regarded as a reservoir of moisture. Walter H. Evans, in an account of the "Lichens of Indiana," gave an account of the habits and structure of Lichens and the methods of collecting these plants. He stated that he had already recognized seventy-six species of Lichens in the state, distributed among twenty-eight genera.

J. C. Arthur detailed his investigations on the "Life History of the Plum-leaf Fungus." He found that the summer spores cannot withstand the winter but that soon after the leaves fall to the ground there is a new formation of minute winter spores, the subsequent history of which he had not found out but which he was inclined to regard as male sex spores. No other spores were formed in winter but in spring the fungus took on a new development with the formation of ascospores which ripened in June. From these the leaves were infected and a new growth of the fungus took place.

The last paper was "Man an Evolution—Biological proofs," by T. B. Ridding. The author accepted the principle of evolution but claimed that there must be successive additions of Divine power in order to account for the existing fauna and flora and for the appearance of man.

Committees were appointed looking towards the purchase of scientific works by the State Library and to invite the American Association for the Advancement of Science to hold a meeting at Indianapolis in 1889. It was voted to hold the spring meeting of the Academy May 9, 1888, at Wyandotte Cave. The following are the officers for the coming year. President, J. P. D. John of Greencastle; Vice-Presidents, John C. Brunner, of Bloomington, T. C. Mendenhall, of Terre Haute, O. P. Hay, of Irvington; Secretary, Amos W. Butler, of Brookville; Treasurer, O. P. Jenkins, of Greencastle. It was voted that the past presidents of the Academy be added to the executive committee.